DINAMAP® PRO 1000 Monitor

DINAMAP® PRO 1000 Monitor Operation Manual

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United States
Critikon Company, L.L.C.
4502 Woodland Corporate Blvd.
Tampa, FL 33614

Canada
Critikon Company, L.L.C.
ACT Services
160 Conrad Crescent, Unit 4
Markham, Ontario, L3R 9T9

European Representative
United Kingdom
Critikon, LTD
Monitor House
Unit 3, Cherrywood
Chineham Business Park
Basingstoke Hants RG24 8WF

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Introduction

DINAMAP® PRO 1000 Monitor

Introduction

The DINAMAP® PRO 1000 Monitor is a portable (intra-hospital) multiparameter unit designed for monitoring adult, pediatric, and neonate patient vital signs in subacute care settings, such as same-day surgery, emergency rooms, recovery/PACU, progressive care, interventional radiology, special care units, and GI/endoscopy.

The PRO 1000 Monitor is self-contained and can be powered by batteries or AC. The Monitor has a carrying handle and can be operated on a shelf or table. It can also be mounted in a variety of ways (e.g., wall, pole, bedrail, or head/foot board) using a mounting plate located on the bottom of the Monitor or a pull-out hanger. The Monitor can be used as a stand-alone monitor with the capability to interface to a central station, a server or any other device capable of receiving data using the host communications protocol.

Indications for Use

The PRO 1000 Monitor is intended to monitor and measure oscillometric noninvasive blood pressure (systolic, diastolic, and mean blood pressure), heart rate/pulse, respiration rate, ECG, oxygen saturation (SpO_2) by noninvasive pulse oximetry, and predictive temperature with an electronic thermometer. The PRO 1000 Monitor also detects alarm limit conditions and is capable of recording up to two waveforms. Using this Monitor, a clinician can view, record, and recall clinical data derived from each parameter.

Contraindications

- This device is not designed, sold, or intended for use except as indicated.
- Federal law (U.S.A.) restricts this device to sale by or on the order of a clinician.

Warnings

• If cables and hoses are pulled with sufficient force, unsecured monitors may fall causing injury or equipment damage. To PREVENT injury or equipment damage, install the monitor with mounting hardware recommended by Critikon.

• Do not use the PRO 1000 Monitor in the presence of magnetic resonance imaging (MRI) devices. There have been reports of sensors causing patient burns when operating in an MRI environment.

• To help prevent unintended current return paths with the use of high frequency (HF) surgical equipment, ensure that the HF surgical neutral electrode is properly connected.

• To avoid personal injury, do not perform any servicing unless qualified to do so.

• Disconnect the power supply before servicing.

• To reduce the risk of electric shock, do not open the unit or the power supply. Refer servicing to a qualified service person.

• If the accuracy of any determination reading is questionable, first check the patient's vital signs by alternate means, and then check the PRO 1000 Monitor for proper functioning.

• PACEMAKER PATIENTS: Rate meters may continue to count the pacemaker rate during occurrences of cardiac arrest or some arrhythmias. Do not rely entirely upon rate meter alarms. Keep pacemaker patients under close surveillance. See this manual for disclosure of the pacemaker pulse rejection capability of this instrument.

Cautions

• Arrange the power cord, air hoses, and all cables carefully so they do not constitute a patient strangulation or tripping hazard.

• Verify calibration and ensure that the PRO 1000 Monitor is functioning properly before operating it.

• Allow for heat dissipation by ensuring that the vent in the rear is unobstructed.

• If fluid is spilled on the PRO 1000 Monitor, disconnect the Monitor and contact a qualified service person.

• Do not gas sterilize or autoclave.

• Where the integrity of the external earth conductor in the installation or its arrangement is in doubt, equipment shall be operated from its internal electrical power source.

Notes

- Waveforms may be distorted and readings inaccurate when electrosurgical cautery equipment is used while monitoring with the PRO 1000 Monitor.
- The electromagnetic compatibility profile of the PRO 1000 Monitor may change if accessories other than those specified for use with the PRO 1000 Monitor are used.

Product Compliance

The DINAMAP® PRO 1000 Monitor is classified in the following categories for compliance with IEC 601-1:

- Class I, internally powered
- Transportable (intra-hospital)
- For continuous operation
- Not suitable for use in the presence of flammable anesthetics
- Not for use in the presence of an oxygen-enriched atmosphere (oxygen tent)
- Type BF and type CF applied parts
- Defibrillation protected. When used with the Critikon-recommended accessories, the Monitor is protected against the effects of defibrillator discharge. If monitoring is disrupted by the defibrillation, the Monitor will recover.

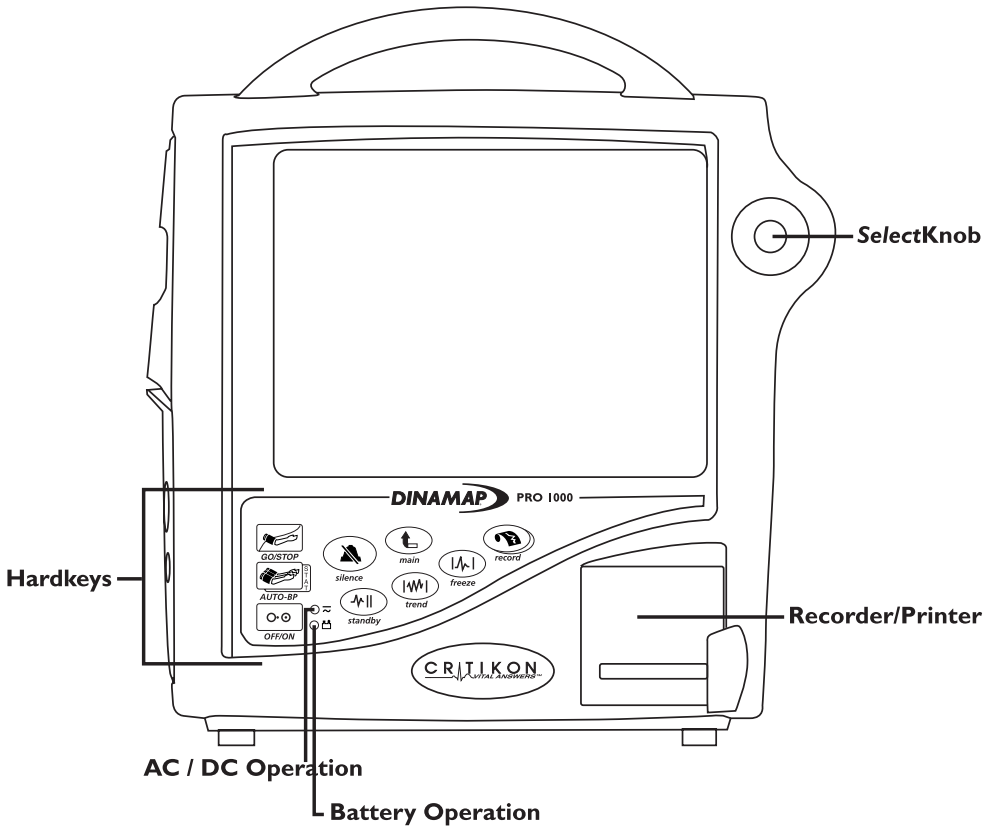
IPX1 The DINAMAP® PRO 1000 Monitor is protected against vertically falling drops of water and conforms with the IEC 529 standard at level of IPX1. Vertically falling drops of water shall have no harmful effects when making contact with the Monitor.

CE 0086 This product conforms with the essential requirements of the Medical Device Directive 93/42. Accessories without the CE mark are not guaranteed to meet the Essential Requirements of the Medical Device Directive.

C SA US DINAMAP® PRO 1000 Monitor is classified with respect to electric shock, fire and mechanical and other specified hazards only in accordance with CAN/CSA C22.2 No. 601.1. Also evaluated to IEC-601-2-30.

- This equipment is suitable for connection to public mains as defined in CISPR 11.
- The signal systems of the Monitor conform to EN 475:1995.
- This Monitor conforms to safety standard for medical devices to IEC 601-1, EN 60601, BS 5724-1, AS/NZS3200.1.0.
- This Monitor conforms to EMC safety standard to IEC 60601-1-2.
- Software is developed in accordance with IEC 601-1-4.
- The ECG parameter conforms to IEC 60601-2-27.
- The SpO_2 parameter conforms to EN 865:1997 with the exception of Clauses 36, 48, sub-clause 51.104.1.
- The NIBP parameter conforms to IEC 601-2-30 with the exception of Clause 36, sub-clause 51.105, EN 1060 Part 1 & 3, ANSI/AMMI SP10 & SP10a.
- The TEMP parameter conforms to ASTM E 1112.

Product Overview

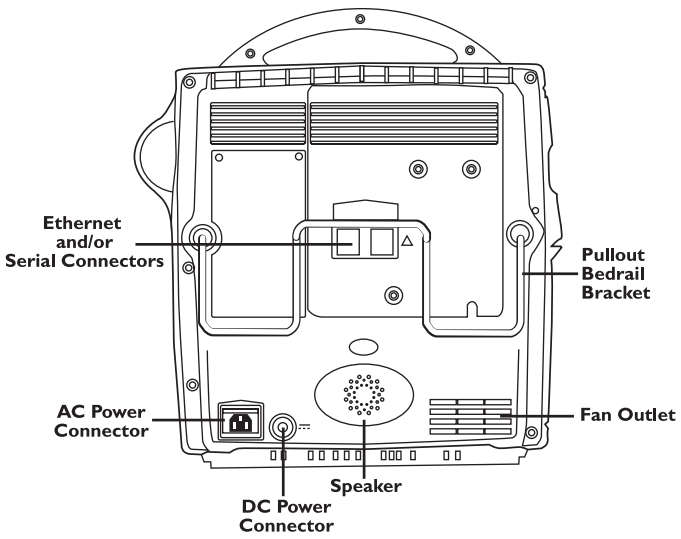


Front of DINAMAP® PRO 1000 Monitor

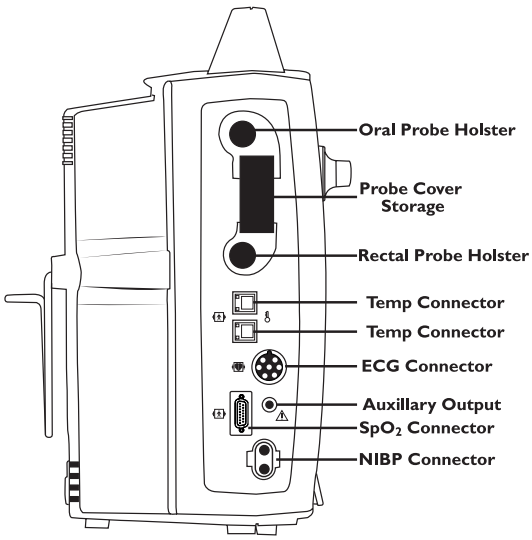
The DINAMAP® PRO 1000 Monitor—which is capable of monitoring adult, pediatric, and neonatal patients—consists of a monitor and a power cord. Using the hardkeys on the Monitor, you can quickly and easily silence alarms, obtain NIBP readings, print data, freeze a waveform, enter standby mode or trends, return to the main screen, and capture a waveform on the screen.

Monitor

The PRO 1000 Monitor is self-contained and has a carrying handle. It can be operated from internal battery or AC (via a power cord). All patient connectors are on the Monitor. On the front of the Monitor are the off/on button, the hardkeys, and the AC/battery power indicators. On the back of the Monitor are the power supply connections, network and device connections (see Appendix), speaker, fan, and a pullout bracket. On the bottom of the Monitor is the mounting plate. On the side of the Monitor are all of the parameter connectors. The PRO 1000 Monitor provides connections for information exchange to other devices/systems, remote alarm, and Ethernet network. The internal battery is capable of powering the PRO 1000 Monitor for 120 minutes (+/- 10 minutes).



Back of Monitor



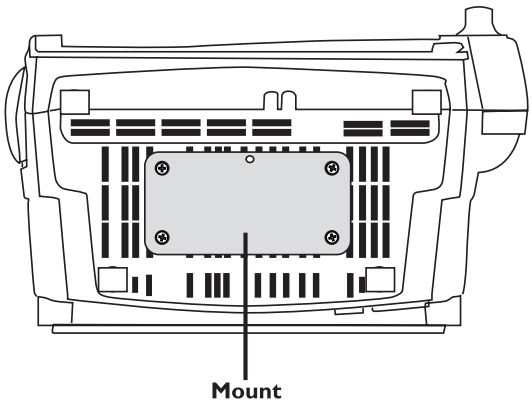
Side of Monitor

Parameters

Parameters in the PRO 1000 Monitor measure a patient's vital signs, and the Recorder/Printer provides a thermal paper strip recording. The waveforms and parameter measurements on the screen vary according to the parameters that are active in the PRO 1000 Monitor. The parameters include noninvasive blood pressure (NIBP), ECG, respiration, predictive temperature, SpO_2, and an optional Recorder/Printer.

Mounting the PRO 1000 Monitor

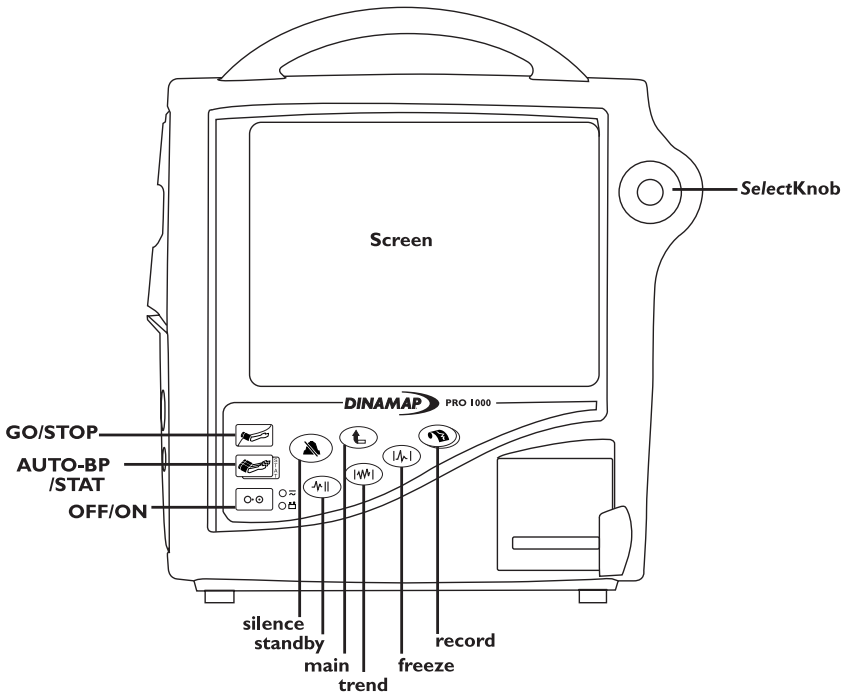
The Monitor is self-contained and portable (intra-hospital). You can mount it in a variety of ways (e.g., shelf, countertop, table, wall, pole, bedrail, or head/foot board) using an accessory mount located on the bottom or the pullout bedrail bracket located on the back.



Bottom of Monitor

Display

The color display can show a maximum of four waveforms and multiple parameter values and menus. You can use the *Select*Knob, hardkeys, and information on the screen to interact with the PRO 1000 Monitor.



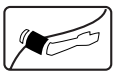
Display

*Select*Knob

The *Select*Knob is a rotary knob with push-button action. Rotating it allows you to navigate through the menus, while pushing it allows you to choose menu options. You can also use the *Select*Knob as a shortcut for closing menus by pressing and holding the knob for two seconds, which acts the same as the Main hardkey.

Hardkeys

Each of the push-button hardkeys activates specific functions. Hardkeys that have double functions are activated by either a quick-press or a press-and-hold. A quick-press means that the hardkey must be pressed for *less* than one second. A press-and-hold means that the hardkey must be pressed for *more* than one second. A confirmation tone sounds when the hardkey becomes active.



GO/STOP - Starts and stops any determination of noninvasive blood pressure.

AUTO-BP/STAT - Dual-function hardkey. Starts **auto BP** determinations with a quick-press and gives you access to change the NIBP cycle time. Starts **stat** determinations with a press-and-hold (5 minutes of continuous NIBP determinations).

OFF/ON - Turns Monitor off and on.

Silence - Temporarily silences alarms; acknowledges alarming crisis conditions.

Standby - Enters and exits standby mode.

Main - Closes the menu system and takes you back to the main screen.

Trend - Enters and exits trends (view patient trends data). This hardkey can be configured in password-protected config mode two ways: to view mini trends or to view full trends.

Freeze - Captures up to 16.8 seconds of waveforms on the screen (seconds vary depending on the chosen sweep speed).

Record - Prints with a quick-press for a timed recording and a press-and-hold for a continuous recording of the chosen waveforms.

Optional Components

Note: Interconnected equipment must be installed by a qualified service person. Refer to the Installation and Configuration Manuals for instructions.

Symbols

The following symbols are associated with the PRO 1000 Monitor.

CE mark

External Communications Port Connector

Attention, consult accompanying documents

Type CF applied part

Battery in use

Canadian Standards Association

Storage temperature

External AC or DC power indicator

External DC power input

External AC power input

Keep away from heat

This way up

Keep dry

Fragile, handle with care

SN Serial number

REF Catalogue number

Predictive temperature

Functional earth terminal (ground lug)

Serial 1

Serial 2

Ethernet

Defibrillator-proof type BF equipment

Defibrillator-proof type CF equipment

Protective earth

Specifications

Mechanical

Monitor	12 in (H) x 4 in (D) x 14.5 in (W) 30.5 cm (H) x 10.2 cm (D) x 36.8 cm (W)

Weight

PRO 1000 Monitor	12 lb (5.5 kg)

Environmental*

Operating Temperature	+41° F to +104° F (+5° C to +40° C)
Storage Temperature	-40° F to +158° F (-20° C to +60° C)
Operating Humidity	5% to 95% noncondensing
Storage Humidity	5% to 95% noncondensing
Operating Atmospheric Pressure	700 hPa to 1060 hPa
Storage Atmospheric Pressure	500 hPa to 1060 hPa

Electrical

AC Input Voltage	120 - 240 V
AC Input Frequency	50 - 60 Hz
AC Input Power	60 - 120 VA
DC Input Voltage	18 - 24 V (supplied from a source conforming to IEC 601-1)
DC Input Power	60 VA (supplied from a source conforming to IEC 601-1)
Internal Battery	12 V nickel-metal-hydride (NiMH)
Fuse (Battery)	10 A, 250 V

Power Supply

The PRO 1000 Monitor can be powered from the internal battery, AC power, or an external DC power source.

Battery

An internal, rechargeable battery pack powers the Monitor for 120 minutes (+/- 10 minutes) at a specified load. The battery typically charges to 90% capacity within 3 hours.

Power Cable

The 16-gauge power cable is detachable and measures 10 ft (3 meters) in length.
Note: When operating on AC power, use only the Critikon-supplied mains power cord to ensure water ingress protection. Labeling of the power cord and/or the Monitor is recommended to avoid accidental use of an alternate power cord that may compromise the IPX1 rating.

* The Monitor may not meet Performance Specifications (ANSI/AAMI SP10) if it is stored or used out of environmental specification ranges.

Using the DINAMAP® PRO 1000 Monitor

Basic Operation

You can turn on the DINAMAP® PRO 1000 Monitor by pressing either the *Select*Knob or the Off/On button when it is plugged into AC power. If the Monitor is using battery power, it can be turned on only by the Off/On button on the front of the unit. Once the Monitor is turned on, the name of each parameter in the mainframe appears as an option under **Setup parameters** in the **Main** menu. When each parameter is ready to begin monitoring, a dedicated portion of the screen is labeled with the parameter name.

On power up, the Monitor performs the following routine in the order listed:

- At initial power up, the fail safe alarm sounds briefly.
- All indicator lights (except the power and battery LED) switch on.
- The screen momentarily displays the Critikon logo.
- The Monitor performs a self-test — the screen displays the model and revision number of the Monitor — and a start-up tone sounds.
- Lastly, the main waveform screen appears.

How to turn on the PRO 1000 Monitor and begin monitoring

1. *Ensure AC power is plugged in and the internal battery has been fully charged.*
2. *Turn on the Monitor.*
   a. When using AC, you can either press the SelectKnob or the Off/On hardkey.
   b. When using the battery, the Monitor can be turned on only by the Off/On hardkey.
   The introductory screen displays the software version briefly.
3. *The waveform screen automatically appears with a popup window and the message,* ***CAUTION! ALARMS ARE TEMPORARILY DISABLED WHILE PATIENT CONNECTIONS ARE REESTABLISHED. IS THIS A NEW PATIENT YOU WOULD LIKE TO ADMIT?*** *Choose* ***Yes*** *or* ***No****. If you choose* ***Yes****, the Monitor performs a quick admission (refer to Admit Patient section for more information).*
4. *Ensure that the necessary cables are connected to the Monitor.*
5. *Ensure that the necessary cables, transducers, and sensors are connected to patient.*

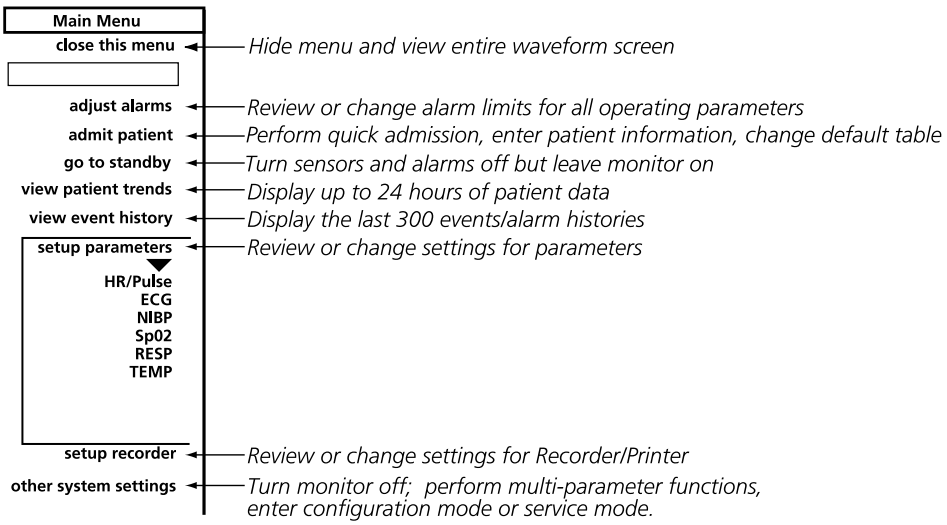
Menus

You can perform most functions on the PRO 1000 Monitor by using menus, which appear on the left side of the screen. The **Main** menu options and their major functions are shown in the following figure. When you choose options from the **Main** menu, you gain access to secondary menus that provide you with additional options for setting monitoring parameters and managing patient data.

Notes

- You can access the **Main** Menu by pressing or turning the *Select*Knob. Some events will also cause the **Main** Menu to automatically appear.
- The menu on the screen automatically closes if there has been no user-interaction for 2 minutes. However, the menu stays open if: 1) the *Select*Box is active, 2) the **freeze** hardkey is active, 3) a monitor mode temperature determination is in progress, or 4) an adjuster menu option is open.
- Pressing and holding the *Select*Knob for 2 seconds closes the menu as long as 1) the *Select*Box is not active, 2) the **freeze** hardkey is not active, 3) a monitor mode temperature determination is not in progress, or 4) an adjuster menu is not open.

- Instructions for the **go to standby** option and for turning off the Monitor are in this section of the manual. Instructions for the other menu options are in sections dealing specifically with their function.

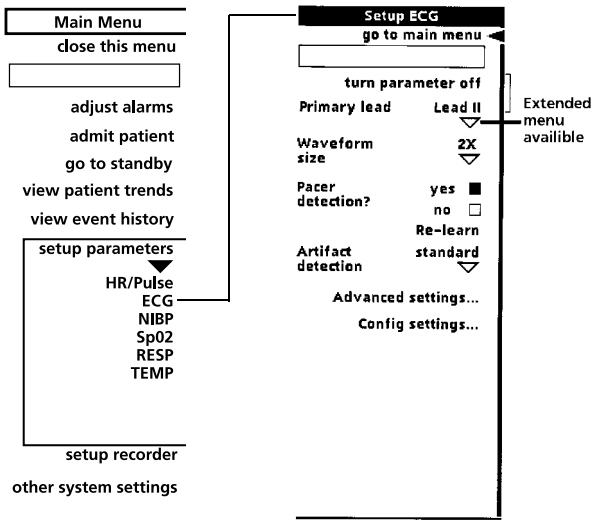

Main Menu
close this menu
Hide menu and view entire waveform screen
adjust alarms
Review or change alarm limits for all operating parameters
admit patient
Perform quick admission, enter patient information, change default table
go to standby
Turn sensors and alarms off but leave monitor on
view patient trends
Display up to 24 hours of patient data
view event history
Display the last 300 events/alarm histories
setup parameters
Review or change settings for parameters
HR/Pulse
ECG
NIBP
Sp02
RESP
TEMP
setup recorder
Review or change settings for Recorder/Printer
other system settings
Turn monitor off; perform multi-parameter functions, enter configuration mode or service mode.

Main Menu Options and Their Functions

Menu Options

In the **Main** menu and in most secondary menus, extended menus are a means of accessing additional options. The **Main** menu has one extended menu (**Setup parameters**), and most secondary menus have one or more extended menus. For example, the **Setup ECG** menu (shown in the figure) has three extended menus. An extended menu is signified by a ▽ symbol under the menu option. When you choose the ▽ symbol, an extended menu appears, and you can then choose from the available options. Some menus contain **adjuster menu options** that appear as a number with a box around it, which is user selectable.

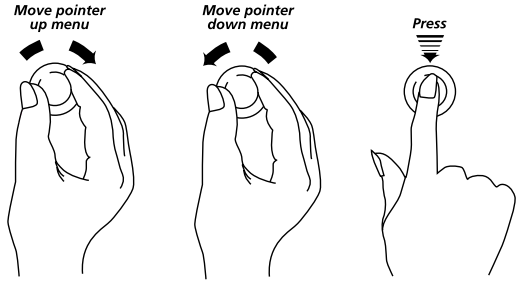
Associated menus, signified by "..." (a series of marks known as an ellipsis), are accessed from secondary menus and offer related menu options. **Advanced settings** and **Config settings** (configuration settings) are associated menus. Once a menu option with an ellipsis is accessed, a new menu appears. You can access **advanced settings** at any time during basic operation. **Config settings** can be viewed in basic operation, but you must be in the password-protected configuration mode to change these settings (see the Configuration Manual for further information).



Relationship of Main Menu to Secondary Menus

Accessing and Using Menu Options

The *Select*Knob lets you navigate through the menus and choose among the various options for patient monitoring and data management, as well as turning the Monitor on. You can also use the *Select*Knob as a shortcut for closing menus by pressing and holding it for two seconds, which acts the same as the Main hardkey.



Using the *Select*Knob

How to navigate through menus

1. *To navigate through the menu options, rotate the SelectKnob.*
2. *Turn the knob clockwise to move the pointer up the menu.*
3. *Turn the knob counterclockwise to move the pointer down the menu.*
4. *To choose a menu option, press the SelectKnob.*
5. *To close all open menus, press and hold the SelectKnob for 2 seconds.*

Menu options make it possible for you to:

- Choose **yes** or **no** in response to a question such as **Pacer detection?**
- Choose only one item from a list. For example, you can choose a respiratory sweep speed of **6.25 mm/s**, **12.5 mm/s**, or **25.0 mm/s**.
- Adjust values. For example, when monitoring NIBP you can change the values for the high and low alarm limit for systolic, diastolic, and mean blood pressures.

Display Screen

Color Format

This option lets you choose to use **mono, limited color,** or **full color** on your monitor screen. **Mono** lets you use only amber and deselected yellow. **Limited color** lets you use only amber, deselected yellow, green, and red. **Full color** lets you use amber, yellow, deselected yellow, red, magenta, light green, green, light blue, blue, and white.

Note: When changing the color format from **full color** to **mono** and back to **full color** again, the **full color** settings will be restored to their previous **full color** settings.

How to select color format

1. *Go to **Advanced settings** in the **Other system settings** menu. In the **Advanced settings** menu, choose **Select color format**.*
2. *A box appears around the current setting. Turn the SelectKnob to change the setting.*
3. *Press the SelectKnob to confirm the new setting.*

Display Colors

When using the PRO 1000 Monitor, a selection of eight colors are available for use on the display. You can choose from yellow, red, magenta, light green, green, light blue, blue, and white. You can choose a different color for each waveform and its associated values and labels.

Notes

- To have access to all available colors, the **full color** option must be chosen in the **Select color format** option.
- Since the HR/Pulse value can be derived from several sources (ECG and SpO_2), you may want to display the HR/Pulse information in the same color as its current source. To do this, choose the **Setup HR/Pulse** menu and open **Advanced settings**. Choose **yes** for **Change color based on source?**

How to change display colors

1. *In the Setup menu of the parameter for which you wish you to change colors, choose **Select XXX's color** in the **Advanced settings** menu. (**XXX** = parameter name.)*
2. *A box appears around the current color setting. Turn the SelectKnob to change the color setting.*
3. *Press the SelectKnob to confirm the new setting.*

Screen

During normal operation of the Monitor, you will see two major types of screens on the display: waveform screens and menu screens. A waveform screen shows you data for the current patient, including vital signs, waveforms, and alarm messages. A menu screen displays current patient data and also lets you perform tasks such as admitting a patient, changing parameter settings, and viewing the event history.

You will see these symbols on the screens.

The symbol ▽ signifies that an extended menu is available.

The symbol ▼ signifies that an extended menu is open.

The SpO_2 Bar indicates the strength of the signal detected by the SpO_2 parameter.

The heart symbol blinks once for every heart beat detected.

• • • The ellipsis appears adjacent to **Advanced** and **Config settings.** It signifies that a related menu is available.

Waveform and Vital Signs Priority

Waveforms and vital signs appear on the screen in order of priority. Where they appear depends on which parameters are active and their respective priority. Parameters are prioritized based on their order of importance for the particular type of patient being monitored. Waveforms appear on in the waveform area in the following order, from top to bottom: ECG, SpO_2, and RESP.

Notes

- In the vital signs field, HR/Pulse always appears at the top.
- In the waveform field, the ECG primary lead (if on-line) always appears at the top. Waveforms for other parameters appear if **View waveform?** is set to **yes** and space is available in the waveform field.

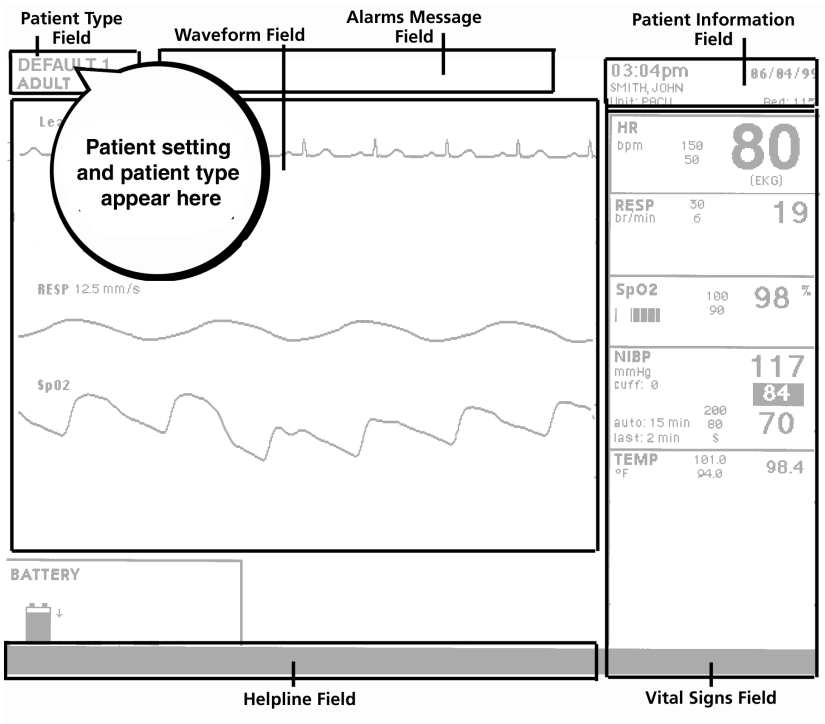
Waveform Sweep Speed

There are three sweep speeds for each cardiac or respiratory waveform. Any change to a cardiac-based sweep speed will affect all cardiac waveforms, unless ECG has **Fixed Primary Sweep Speed** is set to **yes**. Respiratory waveforms are affected in the same manner.

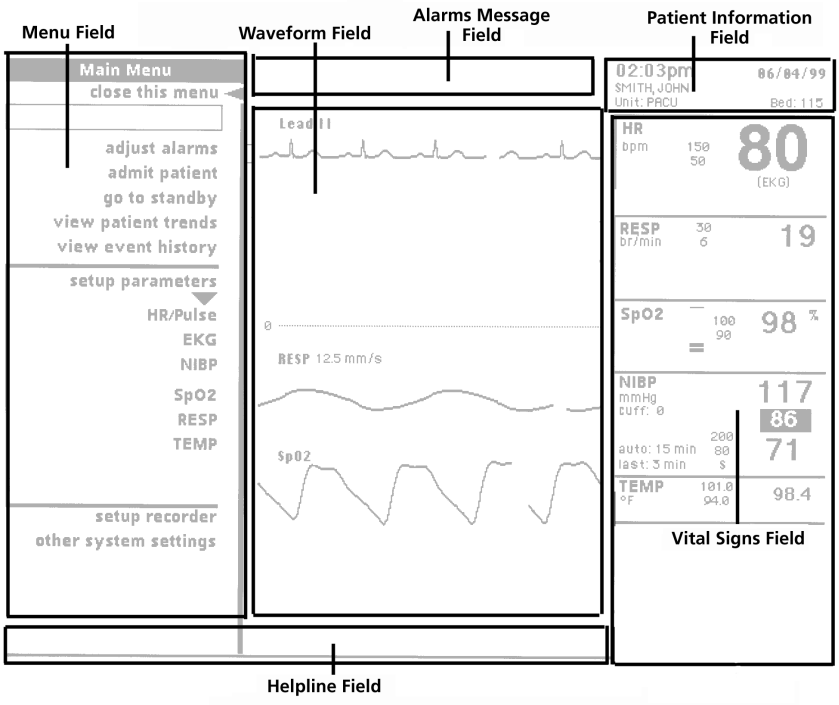
Display Sweep Speed	Time of Displayed Waveform*
50 mm/s	3 seconds
25 mm/s	6 seconds
12.5 mm/s	12 seconds
6.25 mm/s	24 seconds

* Only applies to screens without a menu.

Parameter	Sweep Speeds (mm/s)	Waveform Type	Factory Defaults (mm/s)
ECG	12.5, 25, 50	cardiac	Adult/Ped: 25 Neonate: 25
RESP	6.25, 12.5, 25	respiratory	Adult/Ped: 12.5 Neonate: 6.25
SpO2	12.5, 25, 50	cardiac	Adult/Ped: 25 Neonate: 25



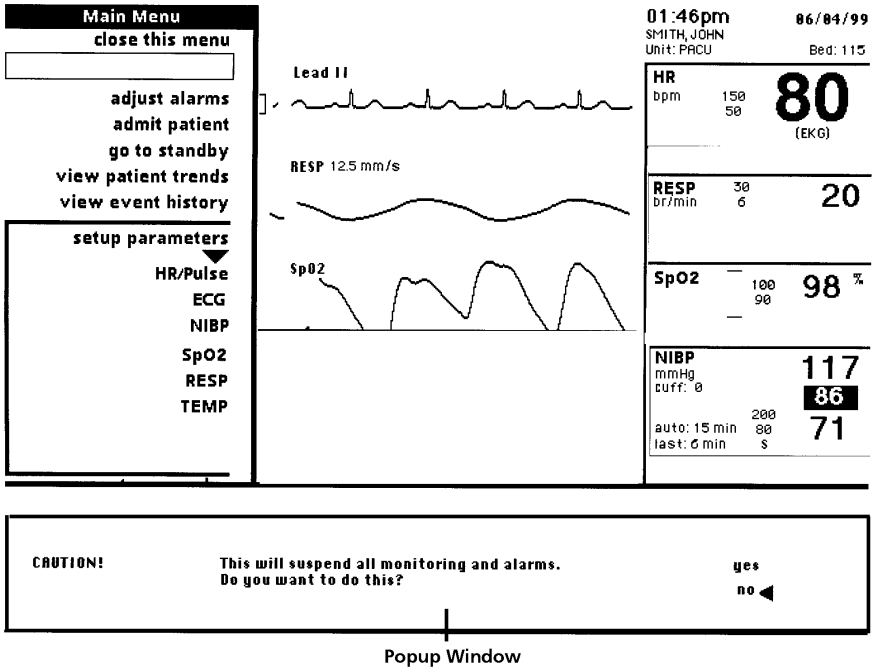
Main Screen



Menu Screen

Popup window

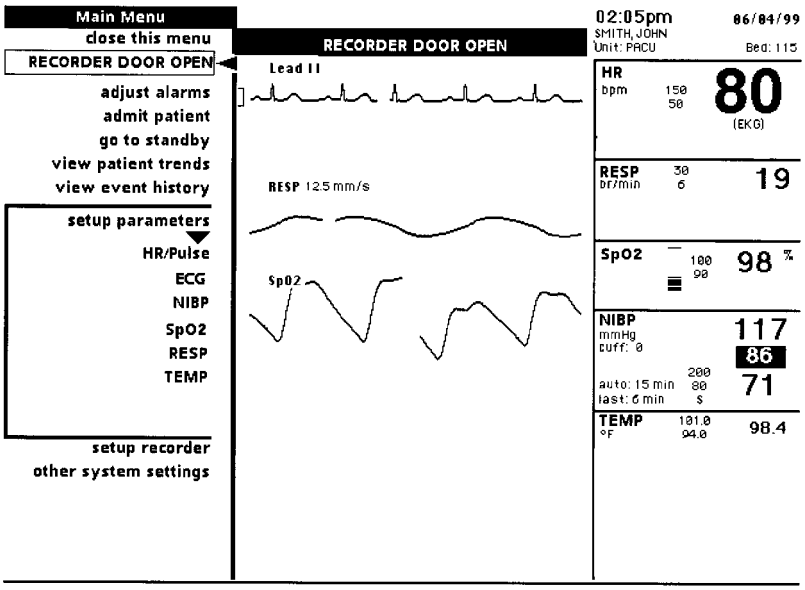
The popup window provides information when a situation requires acknowledgment by the user. In most cases, the popup window remains on the screen until the *Select*Knob is pressed. Menu options will not be accessible until the messages within the popup window are acknowledged. In the example below, the popup window appears if you go to standby. To close this popup window, choose **yes** or **no**.



Screen with Popup Window

SelectBox

The *Select*Box is a rectangle that appears as the second item on every menu. When it is inactive, the *Select*Box is blank and the pointer in the menu skips over it. When the *Select*Box is active, however, a message blinks inside it and you can choose it. The *Select*Box can be activated as a result of a patient alarm, a system problem, or an action you take (e.g., opening the Recorder/Printer door to replace the paper roll).



Screen with Active SelectBox

The following table provides examples of conditions that cause messages to flash in the *Select*Box.

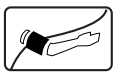
Cause of Message in *Select*Box	Acknowledgment of Message	Resulting Action
freeze hardkey is pressed	Choose *Select*Box	**View frozen waveforms** menu appears
System problem is detected	Correct problem or choose *Select*Box	Message in *Select*Box is cleared and the alarm is canceled
NIBP cannot determine values	Choose *Select*Box	Message in *Select*Box is cleared and the alarm is canceled

Helplines

Helplines appear at the bottom of the screen and continually offer information relevant to the current menu option or task. For example, if the pointer is next to **turn parameter off** in the **Main menu,** the helpline will read **Hint: press *Select*Knob to suspend all monitoring/alarms for this parameter.**

Hardkeys

Each of the push-button hardkeys activates specific functions. Hardkeys that have double functions are activated by either a quick-press or a press-and-hold. A quick-press means that the hardkey must be pressed for *less* than one second. A press-and-hold means that the hardkey must be pressed for *more* than one second. A confirmation tone sounds when the hardkey becomes active.

GO/STOP Hardkey 

The **GO/STOP** hardkey, which turns green when activated, initiates a noninvasive blood pressure determination. If the **GO/STOP** hardkey is active, pressing the hardkey again cancels the determination. If the **GO/STOP** hardkey is pressed while in an auto mode determination, only the determination in progress is canceled; NIBP remains in auto mode. If the **GO/STOP** hardkey is pressed while in stat mode, any determination in progress as well as stat mode is canceled.
Note: The **GO/STOP** hardkey is unavailable if an **OVERPRESSURE ALARM** is active.

How to start or stop an NIBP determination

1. *Squeeze all air from the cuff.*
2. *Place the appropriate cuff snugly on the patient.*
3. *Press **GO/STOP**. The cuff pressure appears in the NIBP field of the screen, and **manual** appears on the screen above the time since the last determination.*
4. *To stop an NIBP determination at any time, press **GO/STOP** during the determination.*

AUTO-BP/STAT Hardkey

The **AUTO-BP/STAT** hardkey initiates auto and stat determinations and opens the Auto BP menu for quick access to set the auto cycle time. The **AUTO-BP/STAT** hardkey remains amber, except in stat mode it blinks.

The time between auto-BP determinations is user-selected (1-, 2-, 3-, 4-, 5-, 10-, 15-, 20-, 30-, 60-, 90-, and 120-minute intervals). The time between stat determinations will be at least 4 seconds (8 seconds for neonates) once the pressure has reached at least 15 mmHg (5 mmHg for neonates).

Notes

- The **AUTO-BP/STAT** hardkey is unavailable if an **OVERPRESSURE** alarm is active. The quick-press function of this hardkey is unavailable if: 1) the **freeze** hardkey is active or 2) an adjuster menu is open.
- During a **stat** determination, the Monitor will sound a tone and display the early systolic pressure. The early systolic value will disappear once the blood pressure determination is complete. Early systolic is not shown for the first STAT determination.
- If the unit is on battery operation and battery life is at or below 10%, **stat** determinations will not be enabled. However, current **stat** determinations will be completed if underway at the time of the **low battery** alarm.

How to start auto-BP determinations

1. *Squeeze all air from the cuff.*
2. *Place the appropriate cuff snugly on the patient.*
3. *Quick-press **AUTO-BP/STAT** with the **Auto BP** menu set to **manual**. The Auto BP menu choice with the selected time interval appears. The cuff pressure appears in the NIBP field of the screen, and **auto : xx min** appears on the screen above the time since the last determination. After each determination, the cuff deflates to allow for venous return.*
5. *To cancel a determination, press **GO/STOP** during the determination. The Monitor remains in auto-BP mode unless returned to the **manual** setting under the **Auto BP** menu.*

How to start stat determinations

1. *Squeeze all air from the cuff.*
2. *Place the appropriate cuff snugly on the patient.*
3. *Press-and-hold **AUTO-BP/STAT**. The cuff pressure appears in the NIBP field of the screen, and **stat** appears on the screen above the time since the last determination. After each determination, the cuff deflates to allow for venous return.*
4. *After 5 minutes, NIBP returns to the previous operating mode.*
5. *To cancel a determination and exit stat mode, press **GO/STOP** during the determination.*

How to quickly change the auto-BP time interval

1. *Quick-press **AUTO-BP/STAT**. The **Auto BP** menu opens and a box appears around the current selection.*
2. *Turn SelectKnob to desired time interval and press to confirm selection.*

OFF/ON Hardkey

The **OFF/ON** hardkey, which turns green while the Monitor is on, turns the Monitor on and off.

Silence Hardkey

When an alarm occurs, the **silence** hardkey flashes red. If you press **silence**, the hardkey remains red but stops flashing. Once an alarm has been silenced and as long as no new crisis alarms occur, the allotted silence time (1 or 2 minutes, user-selectable) must expire before the alarm will sound again or the hardkey will resume its amber color. Any new crisis alarm violation overrides the alarm silence function. You may reactivate the alarms at any time during the silence period by pressing **silence** again.

Crisis Alarms

- If you correct the problem without pressing the **silence** hardkey, the alarm will continue. You must always acknowledge a crisis alarm by pressing the **silence** hardkey.
- If the Monitor is connected to a remote alarm and a crisis alarm occurs, you must press the **silence** hardkey to acknowledge the alarm.

Warning and Procedural Alarms

- If you correct the problem without pressing the **silence** hardkey, the hardkey will return to its amber color.
- If you silence the alarm and correct the problem, the **silence** hardkey remains red until the allotted silence time has expired or until you press **silence** again.

How to silence patient alarms and procedural alarms

1. *Press **silence**.*
2. *For instructions on responding to the alarm, refer to the **Alarms** section.*

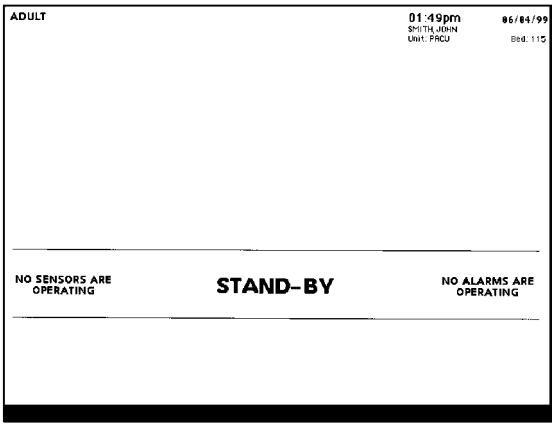
Note: Alarms remain silenced for a predetermined period of time. Any new crisis alarm violation overrides the alarm silence function.

Standby Hardkey

The **standby** hardkey, which turns green when activated, enters the Monitor into the standby mode. When you put the Monitor on standby, you temporarily suspend all patient monitoring and alarm detection. To exit standby, you must press the *Select*Knob or the **standby** hardkey, which automatically initiates patient monitoring and alarm detection. When exiting standby, alarm limits and other parameter settings do not change unless you choose to admit a new patient. If you perform an admit, the Monitor immediately resets all settings and limits according to the default table found in the **admit patient** menu. All parameters are turned off-line and are ready when the appropriate patient connections are made. New patient values are separated from the previous patient in the trends information.

Notes

- The **standby** hardkey is unavailable if: 1) the *Select*Box is active, 2) the **freeze** hardkey is active, 3) an adjuster menu is open, or 4) a popup window is open.
- Standby is available on battery power. The message **SYSTEM ON BATTERY, AC POWER RECOMMENDED** appears.
- If **freeze** is active, the Monitor will not enter into standby mode.



Screen in Standby

How to enter Standby

1. *Press the **standby** hardkey. The Monitor goes directly to standby mode.*
2. *To exit standby and resume patient monitoring, press the **standby** hardkey or press the SelectKnob. Settings and data prior to standby are retained.*

OR

1. *Choose **go to standby** from the **Main** menu. A popup window with the following message appears at the bottom of the screen: **THIS WILL SUSPEND ALL MONITORING AND ALARMS. DO YOU WANT TO DO THIS?***
2. *Choose **yes** to switch the Monitor to standby.*
   ***Note:** After you press the standby hardkey or the SelectKnob, alarms are temporarily disabled and the message **ALARMS ARE TEMPORARILY DISABLED WHILE PATIENT CONNECTIONS ARE REESTABLISHED. IS THIS A NEW PATIENT YOU WOULD LIKE TO ADMIT?** appears. If this is not a new patient, choose **no**. The Monitor automatically defaults to **no** if you do not respond within 30 seconds, and the popup window disappears.*

Main Hardkey

The **main** hardkey, which is always amber, closes the menu system and takes you to the Main screen.
Note: The **main** hardkey is unavailable if: 1) the *Select*Box is active, 2) the **freeze** hardkey is active, 3) or an adjuster menu is open.

Trend Hardkey

This hardkey can be configured two ways: 1) to view mini trends or 2) to view full trends. (The **trend** hardkey must be configured in password-protected configuration mode.) The trended information appears in either graphic or numeric mode, whichever is the default setting. The **trend** hardkey–if configured to full trends–turns green when activated and opens the view patient trend screen. Pressing the hardkey again closes the trends screen. If the **trend** hardkey is configured to mini trends, pressing it turns the hardkey green and opens the mini trends screen. Pressing the hardkey again closes mini trends.
Note: The **trend** hardkey (when configured to full trends) is unavailable if: 1) the **freeze** hardkey is active or 2) an adjuster menu is open.

Freeze Hardkey

The **freeze** hardkey, which turns green when activated, captures up to 16.8 seconds of previous and future waveform data (separated by a caret) for all displayed waveforms. This data is captured and displayed at the same rate as the real-time waveform displayed in the waveform field. The following table lists all available waveform display sweep speeds and the number of seconds captured when **freeze** is pressed.

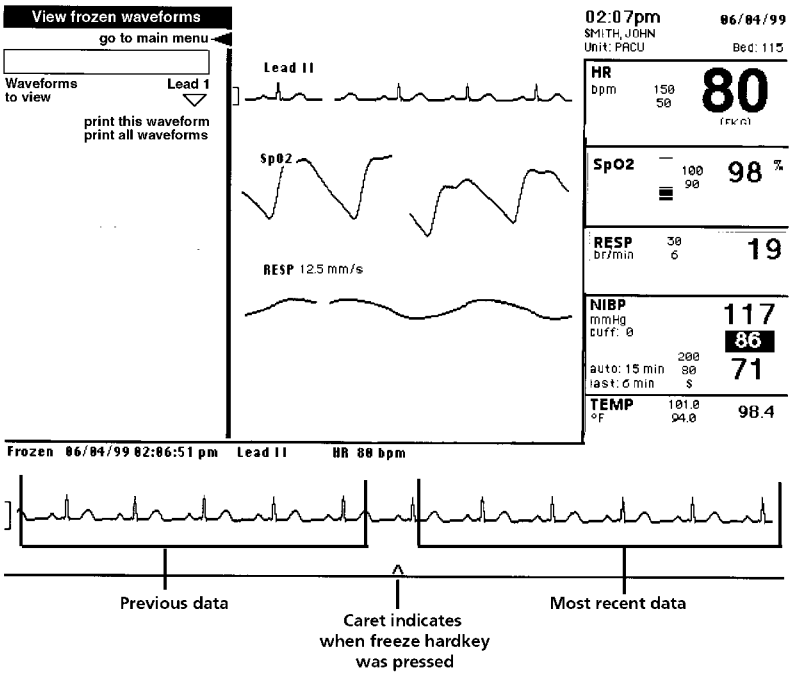
Sweep Speed	Total (Seconds)	Previous/Future (Seconds)
50.0 mm/s	4.2	2.1
25.0 mm/s	8.4	4.2
12.5 mm/s	16.8	8.4
6.25 mm/s	16.8	8.4

When you press the **freeze** hardkey and a waveform is available, a frozen waveform appears in a popup window. To indicate when the **freeze** hardkey was pressed, a caret (^) appears in the middle of the freeze window.

During a freeze when an ECG waveform is available, an event is stored in the patient event history. You can view the frozen ECG waveform at a later time through the **view event history** option in the **Main** menu. Intervals of time are marked on all freeze recordings and appear as a dash at the top and bottom of the recorder strip. These time markers are printed every 3 seconds. If the ECG primary waveform is viewable when a limit or crisis alarm occurs (originating from either the ECG or HR/Pulse parameter), a freeze of this waveform is initiated and stored as part of its associated alarm event. To view this waveform and alarm information, choose the **View event history** option in the **Main** menu.
Note: The **freeze** hardkey is unavailable if: 1) no waveforms are available to freeze or 2) an ECG or HR/Pulse crisis or limit alarm is being saved in the events history.

How to freeze a waveform

1. *Press **freeze** to capture a waveform on the screen. A waveform appears in a popup window at the bottom of the screen and the **View frozen waveforms** menu appears.*
   Notes:
   - *If an adjuster menu item is open, you must first close that option, and then choose the **Waveforms to view** option that appears in the SelectBox.*
   - ***Note:** The **View frozen waveforms** menu is accessed only by pressing the **freeze** hardkey.*
2. *Choose the desired menu options.*
   a. *Choose the **Waveforms to view** option for a list of all active parameters capable of displaying a waveform.*
   b. *Choose the **print this waveform** option to print a frozen waveform from the Recorder. (Available when the printer is not busy.)*
   c. *Choose the **print all waveforms** (Available when the printer is not busy.) option to print all frozen waveforms listed in the **Waveforms to View** option.*
3. *To exit, choose **go to main menu** or press **freeze**.*



View Frozen Waveforms Message

Record Hardkey

The **record** hardkey initiates recordings at the recorder/printer. The hardkey blinks green when in timed mode and printing alarms, and remains green when in continuous mode or printing non-real-time printouts. You can use the **record** hardkey to print to a central station if the **record key printout** option is set to print **at CS** or if the recorder/printer is *not* connected to the PRO 1000 Monitor. The recorder/printer provides thermal paper recordings of patient information such as waveforms and vital signs. (Refer to the **Recorder/Printer** section of this manual for instructions on setting up the recorder/printer.)

How to record a timed printout of patient waveforms

1. *Ensure that paper is properly loaded into the recorder/printer.*
2. *Quick-press **record** to start recording a timed printout of chosen waveforms on the screen.*
3. *Quick-press **record** to stop recording chosen waveforms.*

How to record a continuous printout of patient waveforms

1. *Ensure that paper is properly loaded into the recorder/printer.*
2. *Press-and-hold **record** to start a continuous recording of chosen waveforms on the screen.*
3. *Quick-press **record** to stop recording chosen waveforms.*

***Note:** If the Monitor is in alarm mode, press-and-holding **record** terminates alarm mode and starts a continuous recording. No interruption of waveform recording occurs. If the Monitor is in timed mode, press-and-holding **record** terminates timed mode and starts a continuous recording. Interruption of waveform recording occurs because different waveforms can be selected.*

LED Displays

Battery in Use

An amber LED indicator on the front of the PRO 1000 Monitor illuminates when the unit is operating from battery power. The LED flashes to indicate the remaining battery life is getting low.

AC Operation

A green LED indicator on the front of the Monitor illuminates when the unit is operating from external AC or DC power. The LED flashes if the battery is unable to be recharged.

Loss of AC Power

If the Monitor loses AC power, it automatically switches to battery power without interruption of operation. The following occurs:

- Battery icon appears.
- A single tone sounds to notify you of the power switching from AC to DC or to battery power.
- LED indicators:Battery In Use - ON

  AC power - OFF

Note: If the Monitor has DC power installed and it loses AC power, it automatically switches to DC power first.

Other System Settings

This option lets you access system settings and is found in the Main menu.

turn off system
This option lets you turn the Monitor off.

go to config mode
This option lets you enter into the configuration mode. You must have a password to enter it.

go to service mode
This option lets you enter into the service mode. You must have a password to enter it.

print to CS
This option lets you print a timed central station recording.

Always display battery icon?
This option lets you choose to display the battery icons all the time, even while the Monitor is operating on AC power. Choose **yes** for the battery icon to always appear on the display screen or **no** for the battery icon to appear only when the Monitor is operating on battery power.

Advanced settings
Select color format

This option lets you choose the color format for the monitor's display screen. Choose **mono, limited color,** or **full color**. Refer to "Display Screen" subhead in this section for further instructions.

Adjust keyclick volume

This option lets you adjust the volume of the monitor's keyclick. Choose from **1** to **5** (loudest).

Adjust system volume

This option lets you adjust the volume of the overall system. Choose from **1** to **10** (loudest).

Turning the PRO 1000 Monitor Off

How to turn the monitor off

1. *Depress and briefly hold the Off/On button on the front of the Monitor* ***once****.*

OR

1. *Choose* ***other system settings*** *from the* ***Main*** *menu.*
2. *Choose* ***turn off system****. The message* ***CAUTION! THIS WILL TURN THE SYSTEM OFF. ARE YOU SURE YOU WANT TO DO THIS?*** *appears in a popup window. When you choose* ***yes,*** *the monitor automatically turns off.*

Cleaning

The table below lists proper cleaning agents to be used on the Monitor.

Equipment	Cleaning Agents
screen	isopropyl alcohol, denatured alcohol, 10% bleach solution, or soap and water
cables and leadwired	antibacterial soap and water
exterior of mainframe	germicidal disposable cloth or premoistened cloth with a mild detergent solution

Notes

- Do not use acetone on any part of the Monitor.
- Do not immerse or spray any liquids directly on the Monitor.
- Always verify the efficacy of the recommended cleaning agents. Critikon does not guarantee infection control based on the proper usage of these cleaning agents.

Disposal of Product Waste

As you use the PRO 1000 Monitor, you will accumulate solid wastes that require proper disposal or recycling. These include batteries, patient applied parts, and packaging material. Dispose of these materials according to local or national regulations.

Batteries

Caution: Do not incinerate batteries.

The nickel-metal hydride rechargeable batteries contain no lead, lithium, or cadmium and can be recycled. The U.S. EPA has not provided any specific regulations or guidelines for the waste management of sealed nickel-metal hydride cells or batteries. As a result, a number of states and local governments have passed or are considering legislation which may require special procedures for the disposal of these batteries. Thus, state and local agencies should be contacted for their waste management guidelines. Internationally, procedures for waste management may vary from country to country.

In the absence of regulations or guidelines, the following is recommended for recycling and disposing of used nickel-metal hydride batteries:

- **Recycling:**
  Critikon encourages the recycling of nickel-metal hydride batteries. As recycling programs are implemented for nickel-metal hydride batteries, your Critikon representative will be informed of such programs and will have further information.
- **Disposal:**
  Individual batteries can be disposed of with other household wastes. When 10 or more batteries are accumulated, the commercial user may want to consider disposing the batteries in a secure waste landfill. Since these batteries are not classified as a "hazardous waste," they can be shipped to the secure waste facility as "nonhazardous waste."

Local regulations, which specify other methods for the disposal of nickel-metal hydride batteries, supersede these recommendations. Waste management companies can provide assistance for the disposal of these batteries. As previously stated, nickel-metal hydride batteries should not be disassembled, opened, or shredded. Do not short circuit the terminals.
The nickel-metal hydride battery supplied is recognized by the regulatory agencies as a "dry battery." As such, it is not subject to regulation and can be shipped in normal packaging and transported on any mode of transportation without special handling.

The 3.6 volt nickel-metal hydride, rechargeable, memory backup battery contains no lead, lithium, or cadmium compounds. Discharge this battery prior to disposal. Place the battery in packaging which electrically isolates its contents. Do not puncture or place the battery in a trash compactor. Do not incinerate the battery or expose it to fire or high temperatures.

Patient Applied Parts

Certain patient applied parts, such as those with adhesive (electrodes and disposable SpO_2 sensors), are intended for single use and should be disposed of properly as medical waste. Other patient applied parts, such as blood pressure cuffs should be cleaned according to manufacturer's instructions. Inspect reusable applied parts for wear, replace as necessary, and dispose of used product as medical waste.

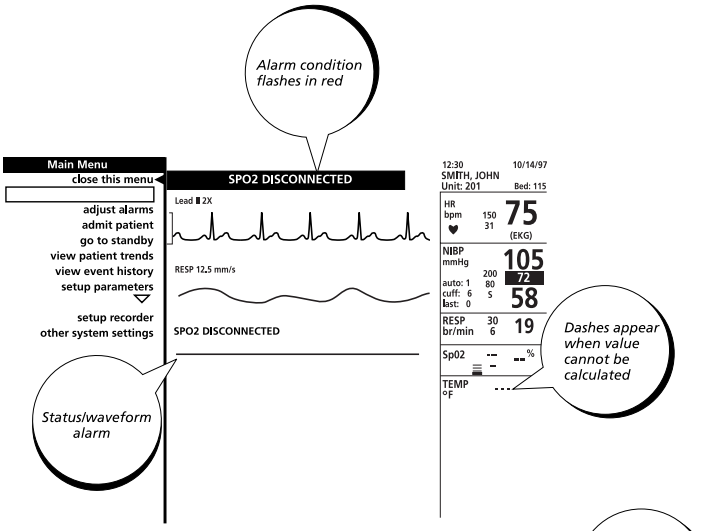
Packaging Material

Retain original packaging materials for future use in storing or shipping the Monitor and accessories. This recommendation includes corrugated shippers and foam/corrugated spacers.

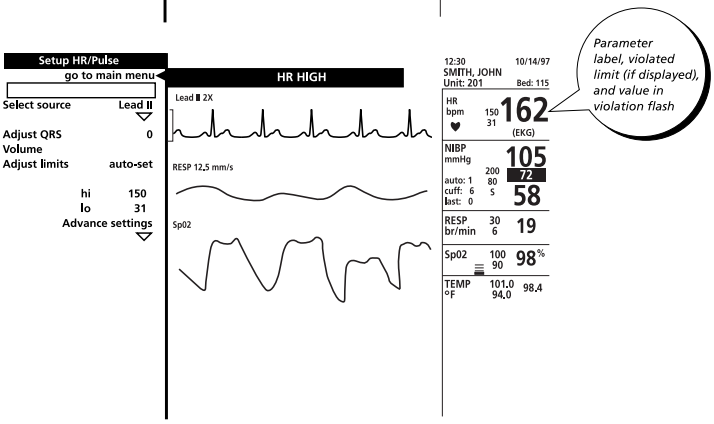
Whenever possible recycle the packaging of accessories and patient applied parts.

Alarms

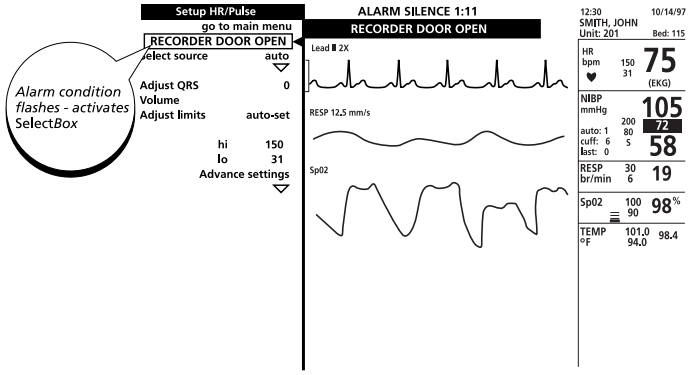
Status/ Waveform Alarm



Limit Alarm



System Alarm



The Monitor provides visible and audible indications of patient- and system-related alarm conditions. Alarm sounds are designed to meet or exceed EN 475 standard. An alarm can generate an audible indication, a message on the screen, a printed document, and an electronic record in the system memory. All active alarm messages appear in the alarm message field. In addition, alarm indicators can appear in the vital signs field, the waveform field, and/or the *Select*box. All active alarm indicators appear in red.

Location	Indication of Alarm
Vital Signs Field	Parameter label, violated limit (if set to display), and value in violation flash. Example: **RESP 30** (limit) **35** (value)
Alarm Message Field	Up to two lines of text Example (top line): **ALARM SILENCE 0:51** Example (second line): active alarm messages such as **RESP HIGH**
Waveform Field	Single line of text above waveform area of parameter in violation Example: **RESP BASELINE SATURATION**
*Select*Box	Single line of text in *Select*Box Example: **RECORDER DOOR OPEN**

Using the **adjust alarms** menu option, you can set alarm limits and volume for all active parameters. In addition, each **setup parameter** menu (except ECG and TEMP) has an **adjust limits** option that lets you set the alarm limits for that parameter. The alarm limit values and alarm volume can be left at the default settings, be adjusted manually, or be adjusted automatically around the patient's current condition.
Note: The default settings are for convenience only and are not intended for all clinical situations. Users should establish appropriate alarm limits.

Interruption of Visible and/or Audible Indications

The visible or audible indications of alarms can be interrupted when one of the following features is activated: alarm disable, alarm volume off, or alarm silence.

- **alarm disable** - When you turn on the Monitor, go into standby mode, or return from standby mode, alarms are temporarily disabled until patient connections are reestablished. The message **ALARMS DISABLED X:XX** appears in the alarm message field until alarms are restored. The visible and audible indications are interrupted while this feature is activated. The following alarms cannot be disabled: **MEMORY LOST, XXX PARAMETER FAILED, XXX PARAMETER ERROR, BATTERY LOW,** and **NIBP OVERPRESSURE.** To resume monitoring, choose the *Select*Box and press the **silence** hardkey.
  Note: XXX denotes the parameter name or label.
- **alarm volume** - If the alarm volume is set to **0**, alarms are indefinitely silenced, including crisis alarms. The message **ALARM VOLUME OFF** appears in the alarm message field. Alarms will not be audible again until the volume is adjusted above **0** (see **Adjust Alarms** Menu).

  Notes

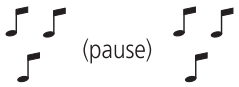
  - Alarm volume can only be set to **0** if this option has been chosen in the Configuration mode.
  - Alarm volume applies to all alarms except system fault alarms.

- **alarm silence** - Any time the **silence** hardkey is pressed, the audible indications for any existing alarms are temporarily silenced. The length of the alarm silence (1 or 2 minutes; user selectable) is set in the Configuration mode.

Alarm Priorities

Most alarms have four priority levels—crisis, warning, procedural, and message—which can be changed to meet the needs of a particular department, patient, or clinician. You can modify the alarm priorities in the **Advanced Settings** menu of the appropriate parameter.
Note: The asystole alarm is set permanently at crisis priority.

Crisis, warning, and procedural alarms have audible tones that differentiate them from each other. Message alarms have no audible indications.

Alarm Priority	Audible indications	Record on alarm?
Crisis	(pause)	yes, if option chosen
Warning	 (pause)	yes, if option chosen
Procedural	(pause)	no
Message	none	no

Crisis

A crisis alarm must be acknowledged by pressing the **silence** hardkey even if the alarming condition has been corrected.

what if...	result
multiple crisis conditions occur at the same time	alarm messages appear sequentially in alarm message field; pressing **silence** hardkey once acknowledges all alarms
alarms have been silenced and a new crisis alarm occurs	new crisis alarm overrides silence; press **silence** hardkey to acknowledge
monitor is connected to remote alarm	alarm cannot be acknowledged from remote location; press **silence** hardkey to acknowledge

Warning

A warning alarm continues until the alarming condition has been corrected. Pressing the **silence** hardkey will temporarily suspend the audible indication.

what if...	result
alarms have been silenced and a new warning alarm occurs	new warning alarm DOES NOT override silence; indication of new alarm will NOT be audible until silence time period has ended

Procedural

A procedural alarm continues until the alarming condition has been corrected. Pressing the **silence** hardkey will temporarily suspend the audible indication.

what if...	result
alarms have been silenced and a new warning alarm occurs	new procedural alarm DOES NOT override alarm silence; indication of new alarm will NOT be audible until silence time period has ended

Message

A message alarm has no audible indication. The visual indication will continue until the alarming condition has been corrected.

Responding to Alarms

If the accuracy of any value is questioned, first check the patient, then the Monitor. When using a remote alarm, the PRO 1000 should be considered the primary alarm source.
Note: Always check the **silence** hardkey and alarm message field to ensure all alarms are enabled again before leaving the Monitor.

How to respond to an alarm

1. *Assess the patient's condition.*
2. *Press **silence**.*
3. *Identify cause of the alarm.*
4. *Correct the alarming condition.*

Silence Hardkey

When an alarm occurs, the **silence** hardkey flashes red. If you press **silence**, the hardkey remains red but stops flashing. Once an alarm has been silenced and as long as no new crisis alarms occur, the allotted silence time (1 or 2 minutes, user-selectable) must expire before the alarm will sound again or the hardkey will resume its amber color. Any new crisis alarm violation overrides the alarm silence function. You may reactivate the alarms at any time during the silence period by pressing **silence** again.

Crisis Alarms

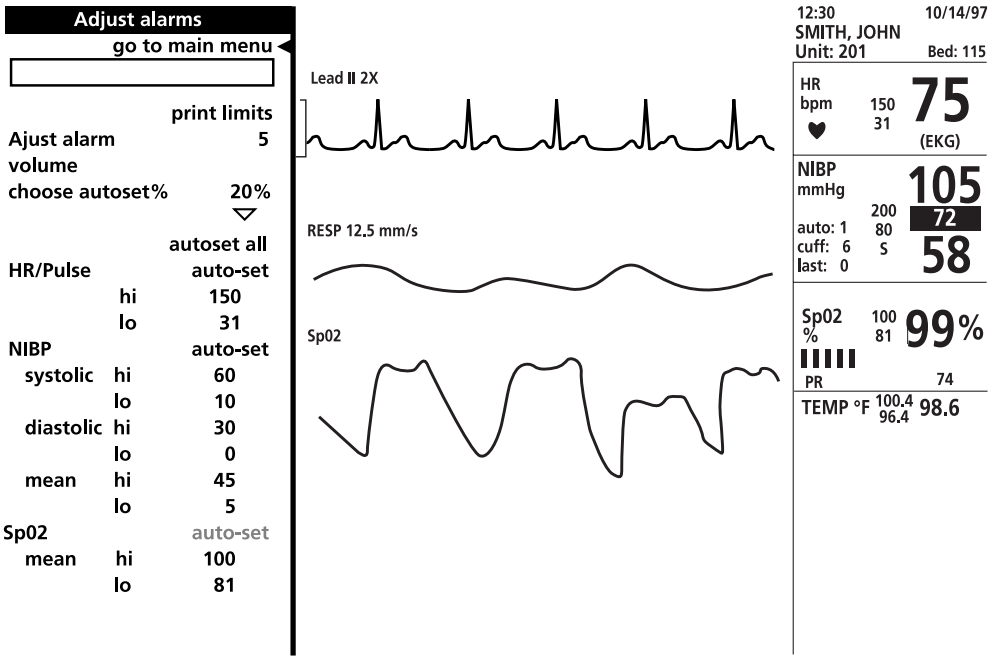
- If you correct the problem without pressing the **silence** hardkey, the alarm will continue. You must always acknowledge a crisis alarm by pressing the **silence** hardkey.
- If the Monitor is connected to a remote alarm and a crisis alarm occurs, you must press the **silence** hardkey to acknowledge the alarm.

- If you correct the problem without pressing the **silence** hardkey, the hardkey will return to its amber color.
- If you silence the alarm and correct the problem, the **silence** hardkey remains red until the allotted silence time has expired or until you press **silence** again.

Alarm Limit Settings

Alarm limit settings are not affected when you turn the Monitor off and then on again unless you choose to admit a new patient. In this case, the alarm limits return to those set in the chosen default. Parameter alarm limits become active when patient values go either above the set high limit or below the low limit (e.g., HR high limit set at 140 bpm. Alarm will become active if HR reaches 141 bpm).

Adjust Alarms Menu



print limits

This menu item lets you print the current alarm limits for all active parameters. This option is available when the printer is not busy.

Adjust alarm volume

This menu option lets you adjust the alarm volume. Alarm volume may be set from **0** to **5** on all parameters (**0** is only available if the chosen set of user defaults was configured this way). Alarm volume applies to all alarms except system faults.
Note: If the alarm volume is set to **0**, the message **ALARM VOLUME OFF** appears on the screen.

choose autoset %

This menu option lets you change the percentage used to adjust limits around the patient's current condition. The percentage can be set to **20%**, **30%**, or **40%**. Once a selection is made, all alarm limits for the active parameters are changed, except for SpO2.

autoset all

When you choose this option, alarm limits are changed according to the last known value for each parameter based on a percentage (see **choose autoset %**).

Notes

- Auto-set alarm limits are provided in each parameter section.
- The only parameters listed in the **Adjust alarms** menu are those that are currently active.
- You cannot use **autoset all** to automatically set alarm limits for SpO_2.

auto-set, hi, lo

These three options allow you to set alarm limits for individual parameters automatically or manually.
Note: You cannot use **auto-set** to automatically set alarm limits for SpO_2.

How to set individual parameter alarms automatically

1. *Choose **Adjust alarms** menu.*
2. *Choose the desired parameter.*
3. *Choose **auto-set**. The chosen parameter's alarm limits are automatically set around the patient's current values. The limits are based on an algorithm and the current readings.*

How to set individual parameter alarms manually

1. *Choose **Adjust alarms** menu.*
2. *Choose the desired parameter.*
3. *To adjust an alarm limit, move the pointer to the appropriate limit and press the SelectKnob. A box appears around the limit.*
4. *Turn the SelectKnob clockwise to increase the number or counterclockwise to decrease the number.*
5. *Press the SelectKnob to confirm the new limit.*

View Event History Menu

When viewing the event history, patient-related events are viewed separately from system-related events. You can access the last 200 patient-related events and the last 100 system-related events. A maximum of 18 events can be displayed on the screen at any time and events are arranged with the most recent at the top of the screen.

For every alarm generated, an entry is stored either in the Patient Event History, System Event History, or both. Events that are not clearly patient or system related are listed below.

- the admission of a new patient (Patient Event History)
- cancellations of NIBP determinations (both Patient and System Event Histories)
- a change to the alarm or system volumes (both Patient and System Event Histories)
- activation or deactivation of the alarm disable function (System Event History)
- parameter errors and failures (System Event History)
- the activation of **freeze** hardkey (Patient Event History)

Information included with each event:

- date
- time
- condition causing the event
- patient value that violated its limit, for entries associated with limit alarms
- limit violated, for entries associated with limit alarms

- unit of measure
- priority level of the alarm at the time it was generated

If available, a frozen ECG primary waveform is stored with any of the following stored events:

- crisis alarm generated by the ECG parameter
- crisis alarm generated by the HR/Pulse parameter
- **freeze** hardkey is pressed

Events with stored waveforms are indicated by an asterisk (*) in the Wave column. A maximum of 12 patient events may be stored with a frozen waveform. If 12 events exist, the next event with a frozen waveform will replace the oldest stored waveform and event. If this event is still one of the most recent 200 patient events, it continues to appear in the Patient Event History window. However, an asterisk (*) will no longer appear in its Wave column.

choose event history
This option lets you choose to view either the Patient or System Event History window.

view older events
This option lets you view previous events. Each time you press the *Select* Knob, a new screen of events is displayed.

view newer events
This option lets you access the most recent events, including any events stored while the Event History window is open. Each time you press the *Select* Knob, a new screen of events is displayed.

print this page
This option lets you print the list of events currently on the screen. It is available when the printer is not busy and the **crisis events and frozen waveforms** option is closed.

print all pages
This option lets you print all events in the Event History being displayed (either Patient Events or System Events). It is available when the printer is not busy and the **crisis events and frozen events** option is closed. **Note:** If any new events occur while a page of the oldest events is being viewed/printed, then an equal number of the oldest events will be removed from memory and no longer available for printing.

crisis events and frozen waveforms
This extended menu is only available when the Patient Event History window is chosen and there is at least one stored event and the freeze feature is not active.

chose event to view
This option lets you choose to display an event's frozen waveform.

print this event
This option lets you print the chosen event's frozen waveform. It is available when the printer is not busy and a stored event has been chosen.

delete this event
This option lets you delete the chosen events.

delete all frozen waveforms

This option deletes the frozen waveform stored for the chosen event. The associated entry will be removed from the *Events with Frozen Waveforms* window. If this event is still one of the most recent 200 patient events, it will continue to appear in the Patient Event History window. An asterisk (*) will no longer appear in its Wave column.

System Fault Alarm

If a system fault occurs, you will hear a constant tone and the screen will be blanked within 5 seconds. The cause of the system fault is stored in the Alarm History as a fault code.

How to respond to a System Fault Alarm

1. *If the Monitor is alarming, turn it off.*
2. *Contact a biomedical engineer or Technical and Clinical Support at 1-877-274-8456.*

Default Alarm Limits				
Parameter	**Adult/Ped**		**Neonate**	
	Low	**High**	**Low**	**High**
HR/Pulse	50 beats/min (adult) 60 beats/min (ped)	150 beats/min (adult) 160 beats/min (ped)	90 beats/min	200 beats/min
RESP	6 br/min (adult) 10 br/min (ped)	30 br/min(adult) 60 br/min (ped)	15 br/min	100 br/min
NIBP	Systolic: 80 mmHg (adult) Systolic: 70 mmHg (ped)	Systolic: 200 mmHg (adult) Systolic: 150 mmHg (ped)	Systolic: 40 mmHg	Systolic: 100 mmHg
	Diastolic: 30 mmHg (adult) Diastolic: 30 mmHg (ped)	Diastolic: 120 mmHg (adult) Diastolic: 90 mmHg (ped)	Diastolic: 20 mmHg	Diastolic: 60 mmHg
	Mean: 40 mmHg (adult) Mean: 40 mmHg (ped)	Mean: 140 mmHg (adult) Mean: 100 mmHg (ped)	Mean: 30 mmHg	Mean: 70 mmHg
SpO_2	% Saturation: 90 (adult) % Saturation: 92 (ped)	% Saturation: 100 (adult) % Saturation: 100 (ped)	% Saturation: 88	% Saturation: 100

Admit Patient

Admit Patient

Whenever you turn on the Monitor or return from standby, a popup window appears with the message, **CAUTION: Alarms are temporarily disabled while patient connections are reestablished. Is this a new patient you would like to admit? yes or no**. If there is no user interaction within 30 seconds, the Monitor automatically defaults to **no**. However, if you decide to admit a patient, the Monitor immediately resets all settings and limits based upon the preselected configuration and turns all parameters off-line. All parameters are auto-switched on once a patient is admitted and patient connections are made.

If you want to admit a patient during monitoring mode, use the **quick admission** option. This performs all the same operations as selecting **yes** from the *admit popup window,* except parameters are not turned off-line. **Note:** If SpO_2 was previously off-line and a new patient is quick admitted, the SpO_2 parameter does not auto-switch on.

Six different default tables (monitoring configurations) can be set in the password-protected configuration mode. Each default table should contain settings appropriate for a particular patient type (e.g., adult, neonate, etc.). In monitoring mode, you can choose the appropriate table for your patient through **choose patient settings**.

Personal patient information (e.g., patient name, bed number) is entered through the **Admit patient** menu though it is not necessary for an admission or a recording to occur.

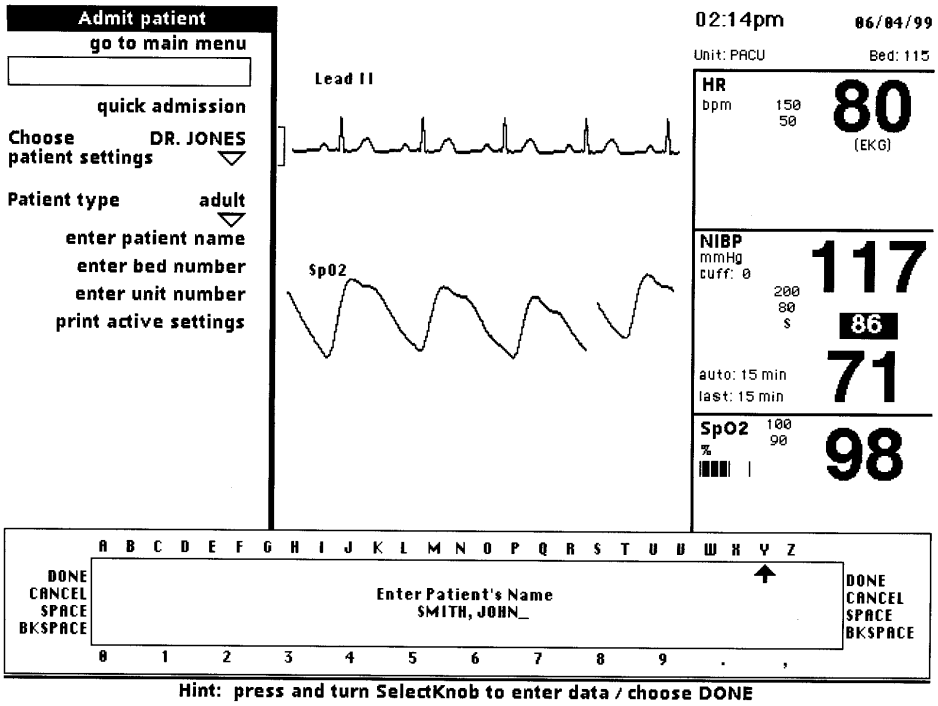
When a patient is admitted, the following changes occur:

- In Trends: New patient values are separated from previous patient's values and the previous patient's name is erased.
- In Event History: Previous patient's waveforms/events are erased. Stored events are not erased.
- All parameters are turned off-line. They will auto-switch on when the appropriate patient connections are made.

General Note

Any time a patient is admitted, the settings return to the chosen set of defaults.

Admit Patient Menu



quick admission

You can use this option to admit a patient at any time during monitoring. However, for optimal results, a new patient should be admitted prior to, or shortly after monitoring for that patient begins.

Notes:

- Check that the settings are correct for the patient you are admitting. If the patient type is not correct, immediately select the appropriate option from **choose patient settings.**
- You can admit a patient without entering the name, bed number, or unit number.
- If you enter the patient's name, bed number, or unit number before choosing **quick admission**, the data you have entered will be erased.

How to admit a patient

1. *Choose **admit patient** from the **Main** menu.*
2. *Choose **quick admission** from the **Admit patient** menu. The message **Admitting new patient, please wait** appears.*
3. *Choose default from **choose patient settings**.*
4. *Enter patient name.*
5. *Enter bed number.*
6. *Enter unit number.*

choose patient settings

This option lets you choose between customized default tables. When a new table is chosen, the Monitor immediately reconfigures itself accordingly. If the menu window is closed, the name of the chosen default table appears in the upper, left corner of the screen. When the menu window is open, it is not viewable. As part of this process, all parameters are turned off-line and auto-switched on as patient connections are made. Patient data continues to be trended for the current patient and this does not erase the current patient's name if it had been entered.

Password-protected configuration mode is where you customize the six different default tables. Each table should be configured for a particular patient type (adult, neonate, etc.). When saving a table's settings, you can enter a name that better describes how/why the table was configured. For example, **DEFAULT 1** can be customized to monitor mothers during labor and delivery and be renamed to **L,D - Mom** and **DEFAULT 2** can be customized to monitor babies after birth and be renamed **L,D - Baby**. Refer to Configuration Manual for more information.

patient type

The patient type is predetermined by the selected default in **choose patient settings** and is changed in the password-protected configuration mode. There are three patient types: **neonate** (under 29 days old), **pediatric** (between 29 days and 18 years old), and **adult** (over 18 years old). When the menu window is closed, the patient type appears in the upper, left corner of the screen below the name of the current default table. If the menu window is open, it is not viewable.

enter patient name

This option gives you access to a popup window containing the alphabet, numbers 0 to 9, and punctuation. You can enter up to 20 characters of a patient's name. The patient's name will appear in the patient information field (upper right corner of the screen) and on strip recordings until a new patient is admitted.
Note: Entering the patient's name is not necessary for admission.

How to use popup window

1. *Turn the SelectKnob to move the pointer to the desired character. Press the Select-Knob to enter the character.*
2. *To add spaces, place the pointer next to **SPACE** and press the SelectKnob as many times as necessary. To delete characters or spaces, place the pointer next to **BKSPACE** and press the SelectKnob as many times as necessary.*
3. *To confirm your choices, place the pointer next to **DONE** and press the Select-Knob.*

enter bed number

This option gives you access to a popup window containing the alphabet, numbers 0-9, and punctuation. You can enter up to 4 characters. The patient's bed number will appear in the patient information field (upper right corner of screen).

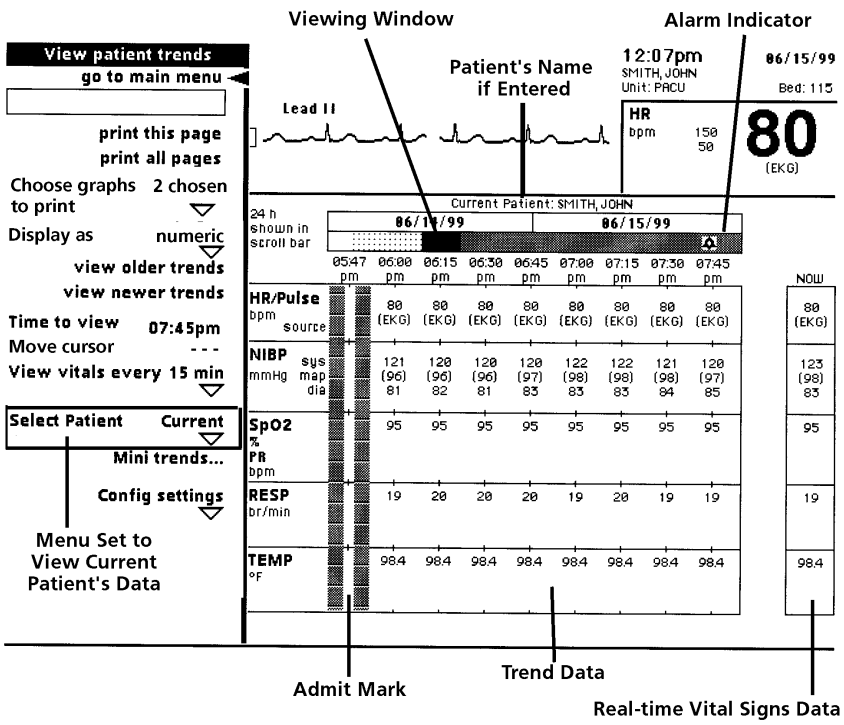
enter unit number

This option gives you access to a popup window containing the alphabet, numbers 0-9, and punctuation. You can enter up to 6 characters. The patient's unit number will appear in the patient information field (upper right corner of screen).

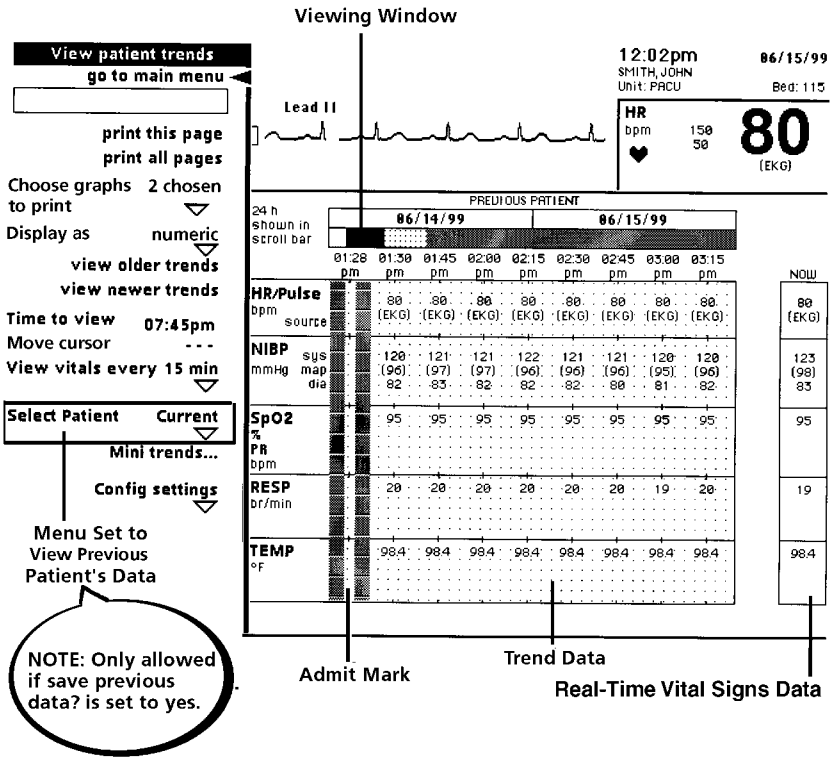
print active settings

This option lets you print all customizable settings for the chosen default table (i.e., Defaults 1 through 6). It is available when the printer is not busy. Once started, a popup window appears with the message **ALL ACTIVE SETTINGS ARE BEING PRINTED. TO CANCEL, CHOOSE OK.** If you choose **OK**, printing will stop. Otherwise, when all settings for the chosen default table have been printed, the popup window disappears.

Trends



Current Patient Trends Screen



Previous Patient Trends Screen

Trends

Trends can be viewed in two different forms: up to 24 hours of data for all parameters (full trends) or a limited set of parameters and data (mini trends). Trends can be accessed through either the **trend** hardkey or the **view patient trends** option in the **Main** menu. The **trend** hardkey can also be configured in two ways: to view full trends or to view mini trends. This hardkey must be configured in the password-protected configuration mode. The **view patient trends** option in the **Main** menu gives you the capability of viewing and printing vital signs and alarms over the previous 24 hours. The trends screen, which is designed in a spreadsheet format, provides up to 10 data points for each parameter being monitored. Trended information can be displayed in two modes: graphic or numeric. The default mode must be configured in the password-protected configuration mode. Once set, the Monitor always returns to the pre-set default mode. The top waveform and the heart rate, with its source, are always visible on the trends screen.

The CURSOR column is an option that allows you to view the time and values associated with trended graphical data. Once activated, a vertical line – a cursor line – appears in the trended data area. Turn the *Select* Knob to move the cursor line across the trended data. As the cursor line touches a plotted point on the graphical trends, the corresponding time and values appear in the CURSOR column. The CURSOR column appears to the left of the NOW column. It is not displayed when the full trends window is initially opened. You can access the CURSOR column by choosing **view patient trends** in the **Main** menu and then choosing **Move cursor**. Once the CURSOR column is activated, you can switch between graphic and numeric modes. The CURSOR column remains activated until the trends screen is closed.

The far right-hand column, called the NOW column, contains real-time vital sign data that is updated every second for the current patient. The 9 columns in a group at the left of the NOW column (and the CURSOR column, if activated) display data at selected time intervals. The data are displayed left to right, oldest to newest. The right-hand column in the 9-column group contains data from the time you select in the **Time to view** option.

A menu option allows you to choose intervals at which to display the data. You can also choose a parameter that is not continuously updated (e.g., NIBP) and view up to 10 data points (including the NOW column) along with the other vital signs taken at the same times.

If a patient alarm occurs while a trends screen is visible, an alarm message appears in the alarm message field and the value causing the alarm flashes in the NOW column. An up arrow next to the value signifies a high limit violation and a down arrow signifies a low limit violation. In addition, an alarm bell icon will appear in the scroll bar to provide a visual reference to the time of the alarm.

When a new patient is admitted, two thick vertical bars known as the ADMIT MARK appear at the appropriate time column and the patient's name appears above the scroll bar. The admit mark is visible for 24 hours. Previous patient data can also be viewed in the 9-column group if your monitor has been configured to do so. Data from the previous patient is displayed with a dot pattern in the background and cannot be viewed at the same time as current patient data. The message, **PREVIOUS PATIENT**, appears above the scroll bar when viewing previous patient data. Data in the NOW column are always from the current patient.

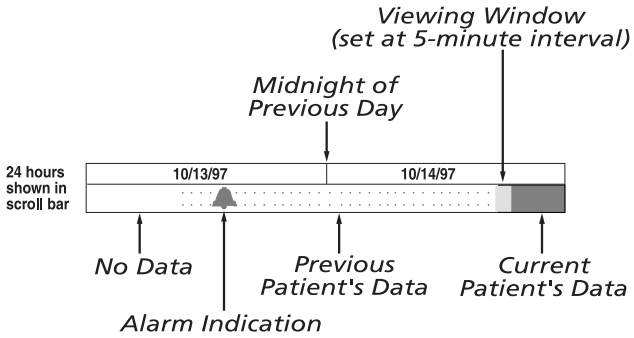
Trend Hardkey

This hardkey can be configured two ways: 1) to view mini trends or 2) to view full trends. (The **trend** hardkey must be configured in password-protected configuration mode.) The trended information appears in either graphic or numeric mode, whichever the default setting. The **trend** hardkey–if configured to full trends–turns green when activated and opens the view patient trend screen. Pressing the hardkey again closes the trends screen, unless a monitor mode temperature determination is in progress. If the **trend** hardkey is configured to mini trends, pressing it turns the hardkey green and opens the mini trends screen. Pressing the hardkey again closes mini trends.

Note: The **trend** hardkey (when configured to full trends) is unavailable if: 1) the **freeze** hardkey is active or 2) an adjuster menu is open.

Scroll Bar

The scroll bar is positioned across the top of the 9 columns in the full trend spreadsheet. It provides you with information about the data obtained in the past 24 hours. If the 24-hour period includes parts of 2 days, a vertical line signifies midnight of the previous day. A dense dot pattern in the scroll bar indicates that data during that time period are from the current patient, and a sparse dot pattern indicates that data are from the previous patient. A lack of dot pattern indicates the time before the previous patient's data. An alarm bell icon in the scroll bar lets you know that at least one data point trended around that time was out of limits.



Viewing Window

Since data are trended every minute over a 24-hour period, only portions of the data can be viewed at one time. A smaller, highlighted bar in the scroll bar, called the Viewing Window, provides an indication of what part of the 24-hour period is being displayed on the screen. The Viewing Window can be helpful when you are using the **Time to view** menu choice. As you scroll through time, the Viewing Window moves and you can position it over the portion of the scroll bar that represents the time you want to view. The most recent trends will always be the portion of time viewed when the full trend window is first opened. The position of the Viewing Window within the scroll bar indicates the relative age of the trends on the screen. If the Viewing Window is positioned toward the right end of the scroll bar, you are viewing more recent data. If the Viewing Window is positioned farther to the left, you are viewing older data. The size of the Viewing Window changes in proportion to the time interval you have chosen in the **View vitals every** menu. The Viewing Window becomes narrower at shorter intervals and wider at longer intervals.

Conventions Used in Trends

The following conventions are used in the trends screen:

- Blanks - parameter not being trended at this time
- Up arrow - high limit violation
- Down arrow - low limit violation
- Sparse dot pattern - previous patient data
- Dashes - invalid data

Notes

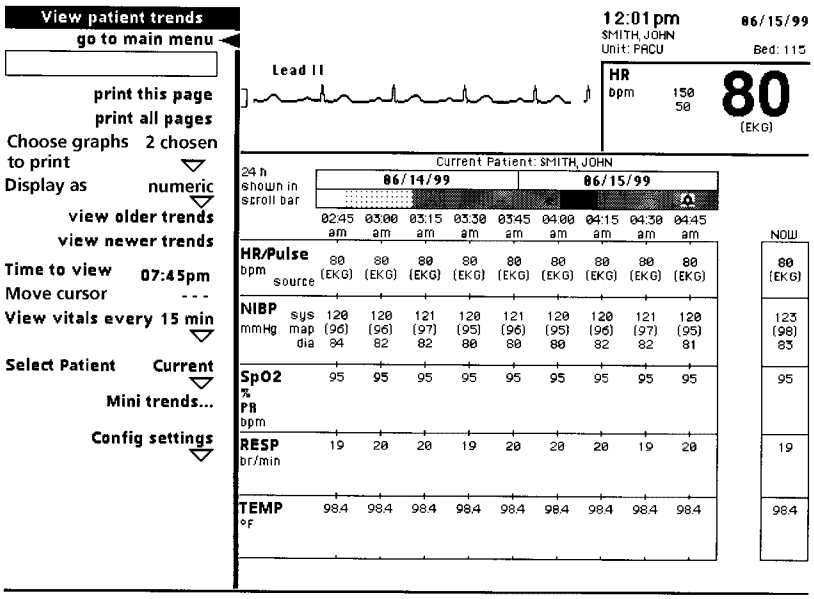
- If **View SpO2 PR?** is set to **yes** and the source of the HR/Pulse is SpO_2, a trended value appears for SpO_2 and dashes for PR. If **View SpO2 PR?** is set to **yes** and the source of the HR/Pulse is not SpO_2, a trended value appears for both SpO_2 and PR. If **View SpO2 PR?** is set to **no**, a trended value appears for SpO_2 and blank appears for PR.

- If the Monitor is unable to detect a pulse for 10 seconds during normal SpO_2 monitoring, the values in the NOW column flash, alternating patient values with dashes. In this instance, only dashes are trended.

How to use patient trends

1. *To access trends, press the **trend** hardkey or select **view patient trends** in the **Main** menu.*
2. *To set the mode in which trended information is displayed, select **Display as**. Select either **numeric** or **graphic**.*
3. *To view additional trends page by page, select **view older trends** or **view newer trends**.*
4. *To view a specific period of time, select **time to view**.*
   a. To view more recent data, turn the SelectKnob clockwise.
   b. To view older data, turn the SelectKnob counterclockwise.
5. *To view a different subset of data (determined by either time intervals or a parameter that is not continuously updated), select **view vitals every**.*
6. *To view trends of parameters not visible on the current screen, select **view more vitals**.*
7. *To view data from a previous patient, choose **Select Patient** and then choose **Previous**.*
   ***Note:** If your monitor is configured for this feature, **Save previous patient data** under the menu item **Config settings** will be set at **yes**.*

View Patient Trends Menu: Numeric



print this page

This option lets you print data currently displayed on the trends screen. It is available when the printer is not busy, trended patient data other than an admit mark is displayed, and **Display as** is set to **numeric**.

print all pages

This option lets you print all stored data for the currently displayed trends. It is available when the printer is not busy, trended patient data other than an admit mark is displayed, and **Display as** is set to **numeric**.
Note: To cancel a print request, press the **record** hardkey once.

Choose graphs to print

This option is not selectable when viewing numeric trends.

Display as
This option lets you choose the mode in which you view the trended data. Two modes are available: **numeric** or **graphic**.

view older trends
This option lets you scroll page by page through the older trends.

view newer trends
This option lets you scroll page by page through the newer trends.

Time to view
This option lets you view data from different times over the last 24 hours. The time displayed above the right-hand column of the 9-column group is the same as the time shown next to the **Time to view** option. When you select **Time to view**, a box appears around the time. As you turn the *Select* Knob clockwise, the time in the box moves forward and the Viewing Window in the scroll bar moves to the right. As you turn the *Select* Knob counterclockwise, the time in the box moves backward and the Viewing Window moves to the left. When the *Select* Knob stops, the new time in the box appears above the right-hand column of the 9-column group and the data on the screen change accordingly. When you have found the desired data, press the *Select* Knob to confirm your choice.

Move cursor
This menu option lets you to view the time and values associated with trended graphical data. Once the CURSOR column is activated, you can switch between graphic and numeric modes. The CURSOR column remains activated until the trends screen is closed. Once you select this option, a cursor line appears in the trended data area. Turn the *Select* Knob to move the cursor line across the trended data. As the cursor line touches a plotted point on the graphical trends, the corresponding time and values appear in the CURSOR column. This option is unavailable when no trend data is available, or **NIBP** or **TEMP** is the confirmed selection of **View vitals every**.

View vitals every
This menu option provides you with two ways of viewing trended information. For continuously updated parameters, you can choose to have the data displayed in 1-, 5-, 10-, 15-, or 30-minute or 1-, 1.5-, 2-, or 3-hour intervals, or as NIBP or TEMP. (NIBP and TEMP are considered episodic – and listed independently – because they are not continuously updated.) Data of parameters not continuously updated are displayed in the time interval when the measurement was taken (e.g., NIBP and TEMP). These time intervals will also include trends for other vital signs. This option is available when **Display as** is set to **numeric**.

Select patient
This menu option lets you view data from either the current or the previous patient when **Save previous patient data?** in the **Config settings** menu option is set at **yes**. When **Save previous patient data** is set at **no**, you can view data from only the current patient.

Mini trends
The mini trends window is displayed at the bottom of the main monitoring screen. It is limited to displaying only the most recent data and only that of the Current patient. The **mini trends** window is an abbreviated version of the full trends screen. Unlike the full trends screen, mini trends only displays HR/Pulse, SpO_2, NIBP and impedance respiration (RESP). When the menu is open, you can view 6 columns of data, and when it is closed you can view 11 columns of data. Mini trends does not contain a NOW column. The trended information in the mini trends window appears in either graphic or numeric mode, whichever the default setting.

Notes

- When battery icon is on, the mini trends window only displays HR/Pulse, SpO_2, and NIBP.
- When the battery icon and mini trends are on, the number of viewable waveforms is limited to two.

View Trends on Main Screen
This menu option lets you turn mini trends on or off. The mini trends window appears on the waveform screen.

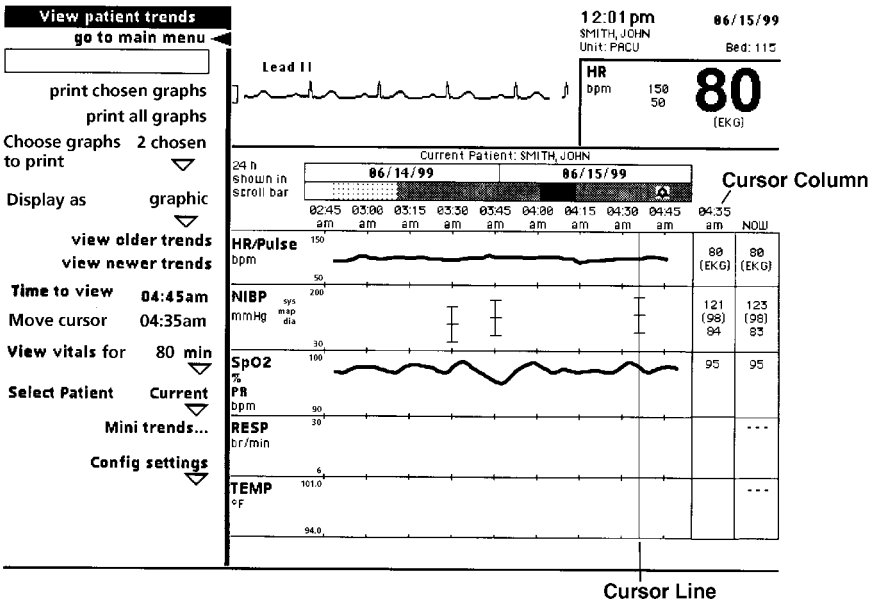
Display as

This option lets you choose the mode in which you view the mini trended data. Two modes are available: **numeric** or **graphic**.

View vitals every

This menu option provides you with two ways of viewing trended information in mini trends. For continuously updated parameters, you can choose to have the data displayed in 1-, 5-, 10-, 15- 30-minute or 1- or 1.5-, 2-, 3-hour intervals. Trends of parameters not continuously updated are displayed in the time interval when the measurement was taken (i.e., NIBP). These time intervals will also include trends for other vital signs.

View Patient Trends Menu: Graphic



print chosen graphs

This option lets you print chosen graphs currently displayed on the trends screen. (Go to **Choose graphs** option to make selection.) If no graphs have been chosen and this option is selected, the top two waveforms are printed. It is available when the printer is not busy, trended patient data other than an admit mark is displayed, and **Display as** is set to **graphic**.

print all graphs

This option lets you print all graphs currently displayed on the trends screen. It is available when the printer is not busy, trended patient data other than an admit mark is displayed, and **Display as** is set to **graphic**.

Choose graphs to print

This option lets you choose which graphs you wish to print. It is available when **Display as** is set to **graphic**.

Display as

This option lets you choose the mode in which you view the trended data. Two modes are available: **numeric** or **graphic**.

view older trends

This option lets you scroll page by page through the older trends.

view newer trends

This option lets you scroll page by page through the newer trends.

Time to view

This option lets you view data from different times over the last 24 hours. The time displayed above the right-hand column of the 9-column group is the same as the time shown next to the **Time to view** option. When you select **Time to view**, a box appears around the time. As you turn the *Select*Knob clockwise, the time in the box moves forward and the Viewing Window in the scroll bar moves to the right. As you turn the *Select*Knob counterclockwise, the time in the box moves backward and the Viewing Window moves to the left. When the *Select*Knob stops, the new time in the box appears above the right-hand column of the 9-column group and the data on the screen change accordingly. When you have found the desired data, press the *Select*Knob to confirm your choice.

Move cursor

This menu option lets you to view the time and values associated with trended graphical data. Once you select this option, a cursor line appears in the trended data area. Turn the *Select*Knob to move the cursor line across the trended data. As the cursor line touches a plotted point on the graphical trends, the corresponding time and values appear in the CURSOR column. This option is unavailable when no trend data is available, or **NIBP** or **TEMP** is the confirmed selection of **View vitals every**.

View vitals for

This menu option lets you choose the span of time to view. You can choose 40 or 80 minutes or 2, 4, 8, 12, 16, or 24 hours. (Dashes are unavailable and cannot be chosen.) It is available when **Display as** is set to **graphic**.

Select patient

This menu option lets you view data from either the current or the previous patient when **Save previous patient data?** in the **Config settings** menu option is set at **yes**. When **Save previous patient data** is set at **no**, you can view data from only the current patient.

Mini trends

The mini trends window is displayed at the bottom of the main monitoring screen. It is limited to displaying only the most recent data and only that of the Current patient. The **mini trends** window is an abbreviated version of the full trends screen. Unlike the full trends screen, mini trends only displays HR/Pulse, SpO_2, NIBP and impedance respiration (RESP). When the menu is open, you can view 6 columns of data, and when it is closed you can view 11 columns of data. Mini trends does not contain a NOW column. The trended information in the mini trends window appears in either graphic or numeric mode, whichever the default setting.

Notes

- When battery icon is on, the mini trends window only displays HR/Pulse, SpO_2, and NIBP.
- When the battery icon and mini trends are on, the number of viewable waveforms is limited to two.

View Trends on Main Screen

This menu option lets you turn mini trends on or off. The mini trends window appears on the waveform screen.

Display as

This option lets you choose the mode in which you view the mini trended data. Two modes are available: **numeric** or **graphic**.

View vitals every

This menu option provides you with two ways of viewing trended information in mini trends. For continuously updated parameters, you can choose to have the data displayed in 1-, 5-, 10-, 15- 30-minute or 1- or 1.5-, 2-, 3-hour intervals. Trends of parameters not continuously updated are displayed in the time interval when the measurement was taken (i.e., NIBP). These time intervals will also include trends for other vital signs.

View vitals for

This menu option lets you choose the span of time to view for the mini trends window. You can choose 50- or 100-minute or 2.5-, 5-, 10-, 15-, 20-, or 24-hour intervals. (Dashes are unavailable and cannot be chosen.) It is available when **Display as** is set to **graphic**.

Recorder/Printer

Description

Using the recorder/printer, you can obtain thermal-paper strip recordings from the DINAMAP® PRO 1000 Monitor. The recorder/printer prints real-time data (e.g., waveforms) and non-real-time (static) data (e.g., trends). Real-time waveforms can be printed in three modes: continuous, timed, and alarm.

Patient identification information (name, patient type, unit number, and bed number), date, and time are printed at the beginning of each strip. Three-second time intervals are marked on all real-time printouts. These time markers appear as a dash at the top and bottom of the recorder strip. Vital signs, information about parameter status, and alarm status information are printed on the recorder strip. When printing graphical trends, up to two graphs can be printed simultaneously. The times that appear on the screen in the trend data area are also printed along the top of the strip from left to right, oldest to newest. The date of the earliest trend data is printed to the left of the oldest time.

A delayed memory option, available in the password-protected configuration menu, allows you to print waveforms and vital signs that appeared on the screen 2 to 12 seconds in the past. Recorded waveforms for ECG are filtered, based on their current settings. ECG filter settings are printed next to the waveform label on the recorder strip.

Record Hardkey

The **record** hardkey lets you start a real-time trace recording (continuous or timed), as well as stop all recordings in progress. Whenever any type of recording is in progress (real-time or static), a quick-press of the **record** hardkey stops that recording. The hardkey blinks green when in timed mode and printing on alarm, and remains green when in continuous mode or printing static recordings. The **record** hardkey is available as long as a waveform parameter is available. However, if a recording is in progress and all waveform parameters fail or become unavailable, the **record** hardkey remains available until the recording in progress is finished printing. If the **record hardkey printout** option is set to **at CS**, quick-pressing the **record** hardkey starts a recording at the central station.
Note: You can use the **record** hardkey to print to a central station if the PRO 1000 Monitor does not contain the optional recorder/printer, the printer becomes disabled, or if configured to do so.

Printing in Continuous Mode

To print in continuous mode, press-and-hold the **record** hardkey on the display. You can control the length of the strip by press-and-holding the hardkey to start printing and pressing again to stop printing. The chart speed is fixed at 25.0 mm/s. If patient alarms occur during printing, they are annotated on the strip. Patient identification is printed at the beginning of the strip. Annotation of vital signs and alarm status information is printed at the beginning and then repeated every 10 seconds. In terms of printing priority, a request for a continuous mode strip interrupts any other printings in progress. An alarm strip in progress continues when a continuous strip is requested, and the new recording mode is annotated on the strip.

Printing in Timed Mode

To print in the timed mode, you can quick-press the **record** hardkey (if configured to do so) or select the **start timed recording** option in the **Setup recorder** menu. The length of the strip can range from 8 to 30 seconds and three chart speeds are available.
Note: Timed mode does not initiate a recording at a central station.

Alarm

When **Print on Alarm?** is set to **yes**, a strip prints automatically when a warning or crisis patient alarm occurs. The alarm priority will override all other modes except continuous. The length of the strip depends on the type of alarm. When a warning alarm occurs, the recorder will print according to the preset **Length of strip**.

When a crisis alarm occurs, the recorder will continue to print a strip until the greatest amount of time, determined by the following, expires: a) all crisis alarm conditions in progress have been removed in addition to the amount of time preset in **Delayed memory** has expired, or b) until the preset **Length of strip** is printed.

When printing, patient alarm messages are annotated as they occur. Patient identification is printed at the start of the strip and annotation of vital signs and alarm status information will be repeated every 10 seconds. The speed is fixed at 25.0 mm/s and has the same delayed memory setting as continuous strip mode.

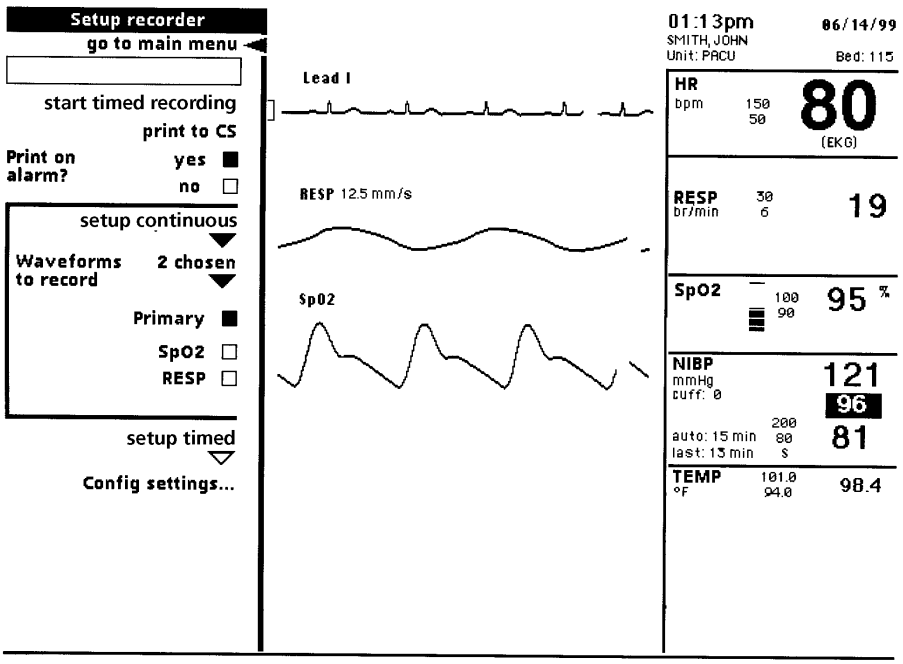
Notes

- Alarms set to message priority will not be annotated on recorder strips.
- System alarms do not automatically start an alarm print.

Printing Priorities

The recorder/printer prints continuous, alarm, timed, and static printouts (e.g., trends, freeze, etc.) in order of priority. Continuous mode takes priority over all other printing. The alarm mode is next in priority and can override timed and static printouts. Timed mode and static printouts are equal in printing priority.

Recorder/Printer Menu



start timed recording

You can use this option to print a 8- to 30-second strip. The length of the strip can be configured either in the user menu or in the password-protected configuration menu. If the recorder/printer receives a request for a continuous or alarm strip, the timed recording will be interrupted and stopped. If patient alarms occur during printing, they are not annotated on the timed strip.

Note: If you have changed an ECG filter or lead setting, allow a minimum of 12 seconds before starting a timed recording in order for the new setting to appear on the recorder strip.

print to CS

You can use this option to generate a timed central station recording. This menu option is available only when communication with the central station has been established. To initiate a timed central station recording, select the **print to CS** option in the **Setup recorder** menu or **other system settings** menu. When the **record hardkey printout** option is set to **at CS**, you can also quick-press the **record** hardkey to start a central station recording. After quick-pressing the hardkey, a helpline appears momentarily at the bottom of the screen stating, **PRINT COMMAND SENT TO CENTRAL STATION**.

print on alarm?

You can use this option to choose whether recordings will print automatically when a patient warning or crisis alarm occurs. The waveform(s) selected for a continuous mode strip appear on an alarm strip as well. The length of the strip is set in the password-protected configuration menu at 20 to 30 seconds. In response to a crisis alarm, however, the strip will continue to print past the set time if the alarm condition has not been corrected. If additional patient alarms occur during printing, they are annotated on the alarm strip. The speed is fixed at 25 mm/s and has the same delayed memory setting as continuous strip mode.

setup continuous

The extended menu that appears when you select this option lets you choose up to two waveforms to be printed in the continuous or alarm modes (the ECG waveform is automatically chosen as long as the parameter is available). If you do not specify a waveform, the waveform with the highest priority will be printed.

setup timed

The extended menu that appears when you select this option lets you choose the waveforms to be printed, the chart speed, and the length of the strip. You can select up to two waveforms; if you do not specify a waveform, the waveform with the highest priority will be printed. You can set the chart speed at **12.5**, **25.0**, or **50.0** mm/s. You can set the length of the strip between 8–30 seconds.

Note: If the length of the strip is set to less than 16 seconds, the 12.5 chart speed is unavailable; or if the chart speed is set to 12.5, the length of the strip cannot be set for less than 16 seconds.

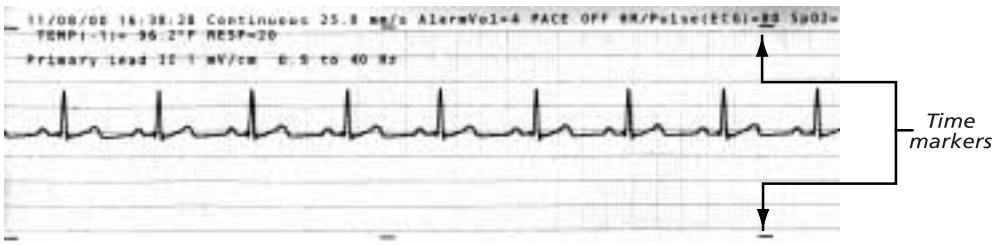
Record hardkey printout

This option lets you choose where the Monitor prints with a quick-press of the **record** hardkey. Choose **at CS** (central station) or **at bedside**.

Note: If the recorder/printer is disabled or not included with the Monitor, **at CS** becomes the default setting.

Sample Printout

Annotation: reflects the vital signs derived at the point in time where the annotation begins.



Vital signs in the annotation are derived based on prior information. The amount of prior information considered is dependent on the parameter-specific averaging interval.

Thermal Paper

The Recorder/Printer requires 2-inch (48 mm) wide extended-life thermal paper (REF 8736, 10 rolls per box).

Storage

Store thermal paper in a cool, dry place. The printed strip (thermal paper recording) should not be

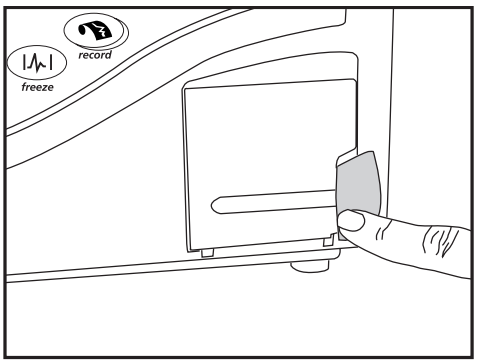
- exposed to direct sunlight,
- exposed to temperatures over 100° F/38° C, or relative humidity over 80%, or
- placed in contact with adhesives, adhesive tapes, or plasticizers such as those found in all PVC page protectors.

Note: When in doubt about long-term storage conditions, store a photocopy of the thermal paper recording.

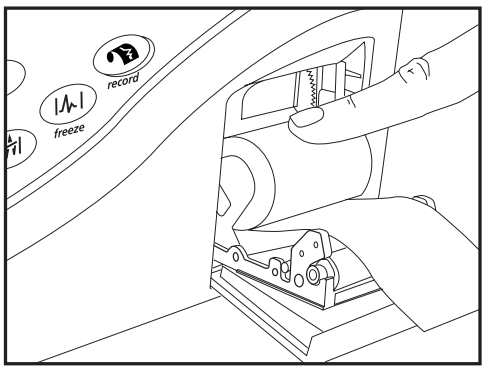
Loading the Printer Paper

Follow these steps to load paper in the recorder/printer.

1. Open the recorder/printer door by pressing the door latch.



2. Remove the paper core.
3. Place a new paper roll between the tabs of the paper holder. The paper should unroll from underneath the paper roll (refer to the following illustration).



4. Begin to close the door while still holding onto and pulling about 2-1/2 to 3 inches (6 to 8 cm) of paper; then close the door completely. You should hear a snap as the door latch is engaged.
5. Ensure that the paper is properly aligned in the paper slot.
6. The recorder will automatically print out a short, annotated strip.

Note: If you load paper in the wrong direction, the recorder/printer will not print properly.

Recorder/Printer Alarms		
Name of Alarm	**Cause**	**Response**
Recorder Out of Paper	recorder is out of paper or paper is jammed	message appears in the *Select*Box and alarm message field
Recorder Door is Open	recorder door is open	message appears in the *Select*Box and alarm message field
Recorder Cannot Print	recorder is trying to trace an abnormally noisy waveform or recorder has an error	message appears in the *Select*Box and alarm message field

ECG

Procedure Checklist

- Plug cable connector into ECG parameter
- Plug lead wires into patient cable block
- Connect lead wires to electrodes
- Choose electrode sites
- Prepare patient's skin
- Apply electrodes to patient
- Provide support for cable and block
- Select **ECG** from **Setup parameters** option in **Main** menu
- Set up monitoring parameters

Description

Electrocardiographic (ECG) monitoring is accomplished in the DINAMAP® PRO 1000 Monitor by an ECG parameter that is in 3-lead configuration. The 3-lead configuration derives a waveform for lead I, II, III, or MCL_1 and displays this waveform as the primary lead. Leads can be changed without changing electrode sites; a waveform cascade feature is included. When 3 electrodes are connected to the patient, waveforms I, II, III, or MCL_1 are available to view and/or record. ECG waveforms can be displayed at sweep speeds of 12.5 mm/s, 25.0 mm/s, and 50.0 mm/s. The vertical scale on the display is indicated by the left-hand bracket which shows the height of 1 mV. The height of the waveform may be decreased by one half or increased by a factor of 2 or 4. You can capture up to 16 seconds of a waveform by pressing the **freeze** hardkey.

When monitoring a patient with a cardiac pacemaker, you can activate a pacer spike detection feature for the primary lead.

The ECG parameter has audible and visible alarms to let you know when a lead is disconnected, to warn you of asystole, and to inform you when significant noise is making it impossible to calculate a heart rate.

ECG is the primary source of heart rate (HR/Pulse) data, which is displayed in the HR/Pulse vital signs field. Instructions for monitoring HR/Pulse are in the Heart Rate/Pulse section of this manual. The color of the HR/Pulse value may change based on the current source.

Indications and Contraindications

The ECG parameter is indicated for use in obtaining electrocardiographic waveforms and heart rate as a component of the DINAMAP® PRO 1000 Monitor. This device is not designed, sold, or intended for use except as indicated.

General Warnings

• Make sure that equipment using high-intensity radio frequencies (e.g., an electrosurgical unit) is properly grounded to reduce the risk of inducing current into cables and electrodes. Such current may interfere with the ECG signal.

• When making connections, attach the lead wires only to the cable and attach the cable only to the ECG parameter.

• Ensure that ECG connectors and electrodes do not come into contact with other equipment and cables, including earth.

• Pacemaker patients should only be monitored with the pacer detector activated.

• During electrosurgical unit use, monitor patients in nonpaced mode.

• Using nonpaced mode in a pacemaker patient may result in inaccurate heart rate averaging. Pacemaker spikes may be interpreted as QRS complexes, and the screen may continue to display a heart rate during asystole or cardiac standstill.

• Do not diagnostically interpret pacemaker spike size and shape.

• Do not use the ECG parameter during magnetic resonance imaging (MRI). Adverse reactions include potential burns to patients as a result of contact with attachments heated by the MRI radio frequency pulse, potential degradation of the magnetic resonance image, and potential reduced accuracy of ECG measurements. Always remove ECG from the MRI environment before scanning a patient.

• When using a defibrillator on a patient being monitored, carefully follow the instructions and cautions provided in the manual for the defibrillator. Ensure that electrodes and patient cables do not contact metal or other conductive objects or surfaces, or grounded parts of equipment.

• When electrosurgical equipment is being used with a patient being monitored, place the electrodes, patient leads, and cables as far away as possible from the surgical site. Also, keep ECG leads away from other equipment. These precautions will reduce the hazard of burns in the event of a defect in the electrosurgical equipment neutral electrode connection.

• Line Isolation monitor transients may resemble actual cardiac waveforms and, thus, inhibit heart rate alarms.

• Use of electrodes with dissimilar metal may cause excessive or accelerated electrode polarization.

• False low heart rate indicators or false asystole calls may result with certain pacemakers because of electrical overshoots.

• An artificial pacemaker spike is displayed in place of the actual pacemaker spike. All pacemaker spikes appear uniform. Do not diagnostically interpret pacemaker spike and shape.

General Cautions

• Inaccurate heart rate and/or false asystoles may result if ECG amplitude is low.

• Follow your hospital's policy when performing defib synch with the PRO 1000 Monitor.

• Pacemaker spikes occurring less than 40 ms prior to the peak of a QRS complex will cause that QRS not to be counted in the heart rate.

• Use only electrodes, lead wires, and cables recommended by Critikon. Failure to use recommended accessories may result in inaccurate readings, damage to equipment, or loss of defibrillator protection.

• The summation of leakage currents when several items of equipment are interconnected, may pose a possible hazard.

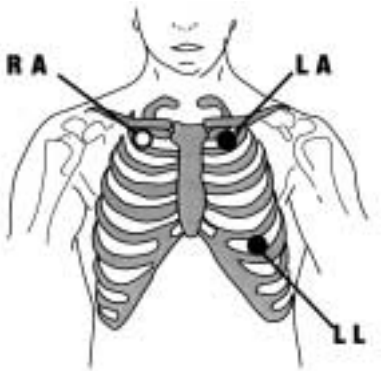
• Route cables away from patient's throat to avoid possible strangulation.

• FDA POSTMARKET SAFETY ALERT – the United States FDA Center for Devices and Radiological Health issued a safety bulletin October 14, 1998. This bulletin states "that minute ventilation rate-adaptive implantable pacemakers can occasionally interact with certain cardiac monitoring and diagnostic equipment, causing the pacemakers to pace at their maximum programmed rate." The FDA further recommends precautions to take into consideration for patients with these types of pacemakers. These precautions include disabling the rate responsive mode and enabling an alternate pace mode. For more information contact:

Office of Surveillance and Biometrics, CDRH, FDA
1350 Piccard Drive, Mail Stop HFZ-510
Rockville, MD 20850
USA

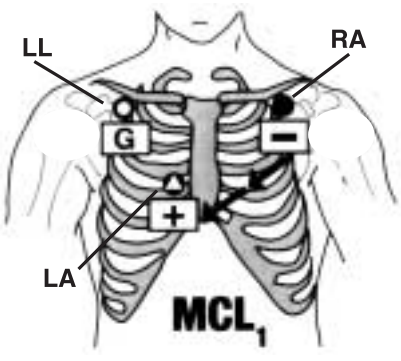
Procedures

1. Plug cable connector into the Monitor.
2. Using appropriate medical criteria, choose the sites for placing the electrodes. The following figure shows some possible sites.



RA (Right Arm) just under right mid-clavicle
LA (Left Arm) just under left mid-clavicle
LL (Leg Leg) lower left rib cage

Electrode Placement Sites



W = RA	RED = (G) BELOW RIGHT CLAVICLE
R = LL	WHITE = (-) BELOW LEFT CLAVICLE
B = LA	BLACK = (+) 4TH ICS TO RIGHT OF STERNUM

MCL_1 Electrode Placement Sites

Number of Electrodes	Waveforms available	Electrodes Required	Waveform Formulas (Electrodes Required)
3	I, II, III, or MCL1 (only 1 at a time)	LA, RA, LL (selectable reference)	I = LA - RA, LL reference II = LL - RA, LA reference III = LL - LA, RA reference MCL1 = LL - LA, RA reference

Color-Coding of Lead Wires

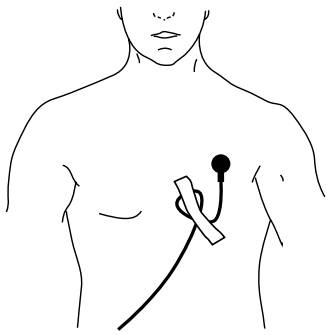
Patient Connection Identifier (3 leads)	**AHA Color (United States Latin America Canada)**
RA	White
LA	Black
LL	Red

Patient Connection Identifier (3 leads)	**IEC Color (International)**
R	Red
F	Green
L	Yellow

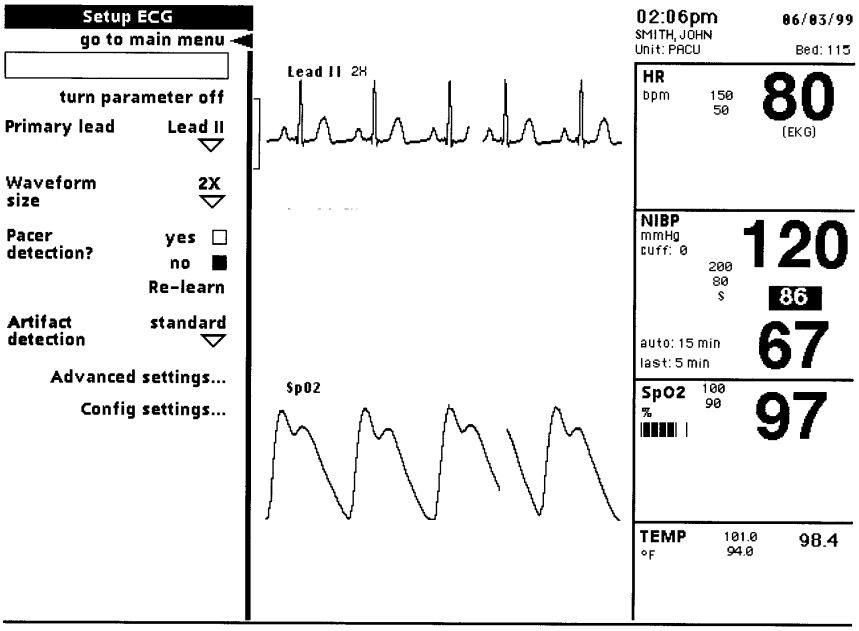
3. Prepare the patient's skin for the electrodes. The following suggestions may be helpful in making sure that the electrodes have good contact with the skin:
   • Shave the hair from each electrode site.
   • Cleanse each site with alcohol to remove skin oils. Then rub the skin dry with a gauze pad or towel.
   • Use mild abrasion to reduce the impedance between the skin and the electrode. To do this, briskly rub each site with a gauze pad.
   • If the patient is diaphoretic, dry the electrode site thoroughly so the adhesive pad will adhere to the skin. If the electrode site cannot be kept dry, you can apply an antiperspirant spray and a thin coat of tincture of benzoin to the peripheral area. Do not apply the spray and tincture to the surface of the skin where you intend to place the gel area of the electrode.
4. Connect the lead wires to the electrodes. (Refer to the table for the IEC and AHA color-coding of lead wires.)
   Caution: Before making any connections, inspect all cables, lead wires, and connectors to ensure that they are not damaged or significantly worn.
5. Following your hospital's or physician's protocol, apply each electrode to the patient at the appropriate site.
   Caution: Before applying the electrodes, check the expiration date.
6. Plug the free end of each lead wire into the proper color-coded receptacle in the patient cable block.
7. Plug the connector end of the cable into the ECG parameter. Look at the ECG primary waveform located at the top of the display. Verify that no other messages are displayed above the waveform after the initial **LEARNING RATE** message is removed. Verify that ECG is the source of the HR/Pulse value.
8. Following your hospital's or physician's protocol, support the cable and the cable block so that their weight does not stress the connections to the patient.
9. Choose ECG from the **Setup parameters** option in the **Main** menu and set up the desired monitoring parameters.

Stress Loop Stabilization

To help minimize ECG artifact, a lead wire pulling at the electrode, or rotating of the lead wire, stress loop stabilization is recommended. Loop the lead wire approximately 2 inches away from the electrode/lead wire connection, and adhere the stress loop with tape to the patient.



ECG Menu



Turn parameter off

This option lets you suspend all monitoring and alarms for ECG. When you choose this option, the message **Offline-ECG** appears in **Setup parameters**. To resume monitoring, choose **Offline-ECG** from **Setup parameters**.

Primary lead

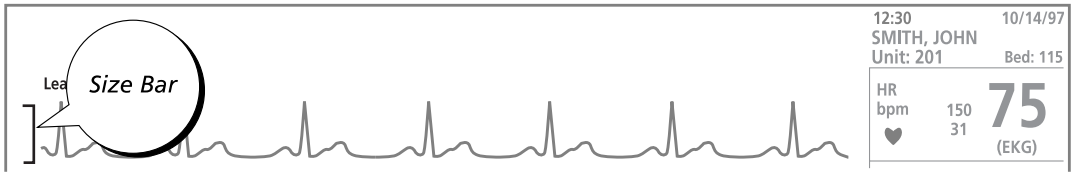
The ECG parameter calculates HR/Pulse from the primary lead, analyzes this lead for pacemaker pulses, and uses the auxiliary output from the waveform as the defibrillation-synchronization lead. With the 3-lead configuration, you can choose lead **I, II, III,** or $\mathbf{MCL_1}$ as the primary lead. The ECG waveform derived from the primary lead is at the top of the screen, and the lead designation appears above the waveform.

Waveform size

This option lets you change the size of the ECG waveform. The standard height (1X) can be changed to **X/2**, **2X**, or 4**X**. The size bar to the left of the waveform area always represents 1 mV of vertical ECG display space. The chosen waveform size appears next to the lead label when it is a setting other than **1X.**

Notes

- Use 1X size to assess the actual amplitude of patient's ECG signal.
- Changing the size of the ECG waveform does not affect heart rate detection.



Size Bar

Pacer detection?

You can use this option to choose the pacer detection function. Choose **yes** when you are monitoring a patient with a pacemaker so that the ECG parameter does not count pacer spikes as heart beats. When pacer detection is active, **PACE ON** appears next to the lead label in the waveform area and a vertical line marks the waveform at each spike. When pacer detection is inactive, **PACE OFF** appears next to the lead label. Do not use pacer detection while electrocautery (bovie) is in use.

Notes

- Use standard lead placement for pacer detection. Pacer detection is done in the primary lead. Go to **Primary lead** and choose the best lead for accurate HR detection.
- Large surface potentials such as those encountered with external (transcutaneous) pacing may result in an inability to display ECG waveforms. Reducing the ECG scale to X/2 may allow these waveforms to be displayed.

Re-learn

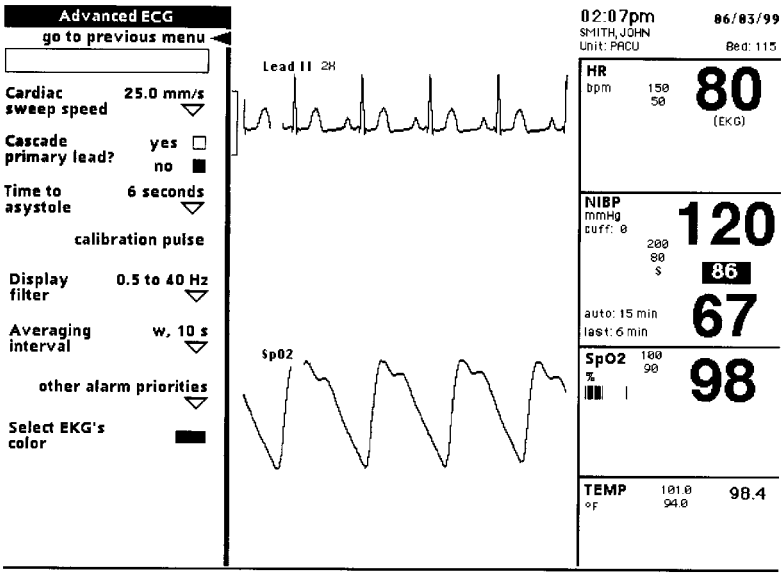
When you choose this option, the parameter will learn the new ECG pattern and correct the calculations of the HR/Pulse value. Use **relearn** whenever any dramatic change has occurred in the patient's ECG pattern and when ECG electrodes are changed or moved. The **Learning Rate** message appears the first time a patient is connected to the ECG parameter, when the primary lead is changed, following long periods of excessive artifact, or when you choose the option **Re-learn** from the **Setup ECG** menu.

Artifact detection

This option lets you change the amount of motion artifact that is allowed in the primary lead waveform before indicating an artifact condition. The choices are **standard**, **low**, and **OFF**. The **low** setting allows more artifact in the waveform than does the **standard** setting. If you need to monitor an ECG with 60 Hz noise in the waveform, you may find it helpful to turn artifact detection off. (Even if a waveform is present, HR may not appear in the presence of 60 cycle interference.)

Note: Turning detection off may affect accuracy of HR, since artifact spikes may now be detected as QRS.

Advanced settings



Cardiac sweep speed

You can use this option to set the sweep speed at **12.5 mm/s**, **25.0 mm/s**, or **50.0 mm/s**. The chosen sweep speed appears next to the lead label in the waveform field when it is a setting other than **25.0 mm/s**.

Notes

- Changes you make to the sweep speed in this option will change the sweep speed of all cardiopulmonary waveforms, with the possible exception of the primary lead ECG waveform. If the sweep speed of the primary lead waveform has been fixed at 25.0 mm/s in the configuration mode, the sweep speed of the primary lead waveform will remain at 25.0 mm/s regardless of changes to the sweep speed of the other cardiopulmonary waveforms.
- If **fixed primary sweep speed** is set to **yes**, the ECG **cardiac sweep speed** menu option is not available.

Cascade primary lead?

This option lets you view double the number of seconds of data on the screen. When you choose **yes**, the primary waveform extends to an additional field below the original field.
Note: Mini trends window disables the cascading feature.

Time to asystole

This option lets you choose how many seconds must pass with no heart beat detected before the parameter issues an asystole alarm. You can choose **3, 4, 5**, or **6** seconds.

Calibration pulse

When you press the *Select*Knob to choose this option, one cycle of a ± 0.5 mV square wave appears in the primary waveform.

Display filter

This option sets the filtering level of high frequency noise interference. You can choose **0.05 to 100 Hz** for diagnostic mode, **0.05 to 40 Hz** for ST measurement mode, or **0.5 to 40 Hz** for standard monitoring mode. The chosen filter appears next to the lead label in the waveform area when it is a setting other than **0.5 to 40 Hz**.

Averaging interval

This option lets you specify how the heart rate is calculated. You can choose the number of seconds used in averaging and the type of averaging. You can choose **straight, 5 s**; **straight, 10 s; weighted, 5 s**; or **weighted, 10 s**. The straight algorithm averages every R-R interval over the selected time interval. The weighted algorithm uses only the most common R-R intervals over the selected time interval when determining heart rate.
Note: For chronic-controlled atrial fibrillation, use 10 s. straight averaging. For intermittent or uncontrolled atrial fibrillation, use 10 s. weighted (default) or 5 s. weighted.

other alarm priorities

This option lets you choose priorities for **lead fault**, **amplitude low**, **replace electrodes**, and **artifact**.

Notes

- In addition to crisis, warning, procedural and message, the priorities of **artifact** and **amplitude low** can be set to **OFF**.
- If **artifact** is set to **OFF**, the **ECG ARTIFACT** alarm is disabled. Continuous detection of artifact prevents the ECG parameter from calculating a heart rate. See subsection *Artifact Message Troubleshooting*.
- If **amplitude low** is set to **OFF**, the **ECG AMPLITUDE LOW** alarm is disabled.

Alarms

With 3-lead configuration, an alarm message will appear in the waveform field next to the primary waveform lead label if the parameter detects asystole or loss of all ECG waveforms. In addition to the asystole alarm, which you can adjust in the **Advanced ECG** menu, the alarm limits that may be associated with ECG are high and low HR/Pulse and high and low RESP. You can view or change these limits in two ways:

- Choose **adjust alarms** from the **Main** menu and then choose **HR/Pulse** or **RESP**.
- Choose **HR/Pulse** or **RESP** from **Setup parameters** in the **Main** menu. Then choose **adjust limits** from **Setup HR/Pulse** or **Setup RESP**.

Instructions for setting the HR/Pulse alarms are in the Heart Rate/Pulse section of this manual, and instructions for setting up the RESP alarms are in the RESP section. Additional information about alarms is in the Alarms section.

Calibration

The ECG parameter does not require calibration.

Auxiliary Output

The auxiliary output connector provides an analog ECG waveform output. The analog ECG waveform signal is a high level (1 V/mV) representation of the primary lead. To properly connect equipment to this output, please refer to the Appendix.

Accessories

One of the following accessory kits are shipped with each ECG parameter. ECG electrodes are single-patient use. Debfibrillator protection requires the use of Critikon-recommended cables.

ECG Parameter Starter Kit, Neo/Ped 3-Lead, AHA containing:
3 Lead Neo/Ped AHA Cable
3 Lead Ped AHA Mini Grabber Wire Set
3 Lead Neo AHA Electrodes w/pre-attached Lead Wires

ECG Parameter Starter Kit, Neo/Ped 3-Lead, IEC containing:
3 Lead Neo/Ped IEC Cable
3 Lead Neo AHA Electrodes w/pre-attached Lead Wires

ECG Parameter Starter Kit, Adult 3-Lead, AHA containing:
3 Lead Adult AHA ECG Cable
3 Lead Adult AHA Wire Set (Snaps)

ECG Parameter Starter Kit, Adult 3-Lead, IEC containing:
3 Lead Adult IEC ECG Cable
3 Lead Adult IEC Wire Set (Snaps)

ECG Parameter Starter Kit, 3-lead, AHA for OR containing:

3-Lead Adult ESU Cable, 10 ft
3-36 inch (nominal) Leads with Snaps
3 Adult Disposable Electrodes

ECG parameter Starter Kit, 3-lead, AHA for OR containing:

3-Lead Adult ESU Cable, 10 ft
3-36 inch (nominal) Leads with Grabbers
3 Adult Disposable Electrodes

ECG parameter Starter Kit, 3-lead, IEC for OR containing:

3-Lead Adult ESU Cable, 305 cm
3-100 cm Leads with Grabbers

If the ECG cable is equipped with an ESU filter, impedance respiration (RESP) cannot be monitored.

Recommended

Cables with 3 wires can be used. Use only standard silver-silver chloride (Ag-AgCl) ECG electrodes. Use connections meeting AAMI standards.
Note: Three-lead cables that internally connect LL to RL or LA to RL should not be used. Such a cable would connect the LL or LA signal to the RL circuitry, interfering with normal operation.

Specifications

Leads available	3-lead configuration: I, II, III, MCL1
QRS amplitude range	0.2 to 5.0 mV
QRS duration range	15 to 200 ms (does not reject 10 ms, 1 mV QRS)
Heart rate accuracy	10 to 300 (adult/ped) / 10 to 350 (neonate) beats/min ± 3 beats/min or 3% of reading, whichever is greater
Heart rate resolution	1 beat/min
Bandwidth:	
Display/Recorder	0.5 to 40 Hz 0.05 to 40 Hz 0.05 to 100 Hz
Standardizing voltage	1 mV marker
Common mode rejection	1 mV RTI or 10 mm p-p max displayed noise allowed with 20 Vrms, 50-60 Hz input
Input Impedance:	> 2.5 MΩ at 10 Hz
60 Hz tolerance	up to 10 mV (with artifact detector off) up to 300 mV (at 1 mV QRS and artifact detector on)
Pacemaker detection/rejection	
Pacer amplitude	± 2 mV to ± 700 mV
Pacer width	0.1 µs to 2 ms
with under or overshoot of	2 mV, 70 ms duration
Pacer amplitude	± 2 mV to ± 700 mV
Pacer width	0.1 ms to 2 ms
Tall T wave rejection:	100%
Lead off sensing current:	< 0.1 µA DC signal leads < 1 µA DC driven lead
Time to alarm:	high heart rate < 10 s per AAMI EC13 - 1992 low heart rate < 10 s per AAMI EC13 - 1992 cardiac standstill < 10 s per AAMI EC13 - 1992 tachycardia waveforms < 10 s per AAMI EC13 - 1992

Artifact Message Troubleshooting

In general, **Artifact detection** should be set at **standard** and the priority of the artifact alarm should be set at **procedural**. The artifact message indicates that the waveform signal integrity is degraded because of "noise" in the waveform. The noise source could be generated by muscle interference due to patient movement, 60 (or 50) cycle interference, baseline "wandering," saturation due to mechanical movement of one or more electrodes, or poor electrode connection.

Frequently, when the artifact condition is initially detected, the ECG parameter continues to report the last calculated heart rate. During this time, a visual message appears next to the primary lead label (in the same color as the primary waveform), and no alarm tone is heard.

If the artifact condition continues to be detected, the parameter becomes unable to calculate a heart rate due to the excessive "noise" in the signal. It then reports the heart rate as invalid (dashes). From this point on, the heart rate, as calculated by the ECG algorithm, remains invalid until the "noise" is sufficiently removed.

When the heart rate becomes invalid due to artifact, the ECG ARTIFACT alarm will be generated based upon its priority as set in the menu. When the priority is set to **OFF**, a visual message appears next to the primary lead label (in the same color as the primary waveform) and the alarm tone is not heard. When the priority is set to **message**, a visual alarm is issued (ARTIFACT flashes red next to the lead label) and the alarm tone is not heard. When the priority is set to **crisis**, **warning**, or **procedural**, a visual and audible alarm occurs. However, when the heart rate becomes invalid, if the priority setting is **message** or **OFF** and ECG is the only available source, the ECG ARTIFACT alarm will be generated as a **procedural** priority (visual and audible) alarm. This is done to inform the user that the patient's heart rate cannot be monitored due to the excessive "noise."

When the heart rate becomes invalid due to excessive noise being detected for prolonged periods, users should determine the cause of the artifact. Troubleshooting determines the type of interference present.

Muscle Interference

Muscle interference is generally intermittent and of short duration. If muscle artifact is continuous, the patient may be in distress or the electrodes may need to be reapplied at different sites. The best defense against muscle artifact interference is proper electrode placement, avoiding bony prominences and major muscle groups. Refer to the **Procedures** subhead for instruction on electrode site prep technique.

60 or 50 Hz Cycle Interference

Cycle or line interference (60 or 50 Hz), if present, is usually continuous (e.g., even if a waveform is present, HR may not appear in the presence of 60 cycle interference). It is best to attempt to find the source of the interference and remove it. To determine if there is line interference present in the signal, it may be necessary to change the **Display filter** to **0.05 to 100 Hz**. Noise in the waveform appears on the display as well as on recordings. Since line interference is continuous, it must either be removed or tolerated.

Sources of line interference include faulty lighting (especially fluorescent lights or ballasts), other equipment in the vicinity, or poor grounding. If line interference is present, verify that the electrode lead wires (especially with neonate cables and leads that have no shielding) are running close to each other. Braid the lead wires if possible. This often decreases the amount of interference.

While attempting to determine the source of the interference or if the interference cannot be removed, see subhead **Silencing the ARTIFACT alarm**.

Baseline Wandering

Baseline wandering is generally intermittent but can also be continuous. The intermittent form is typically due to pressing on electrodes, pulling of lead wires, or poor electrode connection. The continuous form is primarily due to respiratory effort.

The artifact detector looks for baseline movements in excess of 2 mV above or below the center. Baseline wandering may not be apparent on the display if **0.5 to 40 Hz** bandwidth is selected. To verify if baseline wandering is present, it may be necessary to set the **Display filter** at **0.05 to 100 Hz** . Often, changing the selected primary lead or repositioning the electrodes eliminates continuous forms of baseline wander. If not, see subhead **Silencing the ARTIFACT alarm**.

Saturation

Saturation is an intermittent condition due to mechanical movement of one or more electrodes or bad electrode connection. Saturation can last for up to 20 seconds from a single saturation event using a bandwidth of **0.05 to 100 Hz** or **0.05 to 40 Hz**. Multiple saturation events can generate longer periods of saturation. With a bandwidth of **0.5 to 40 Hz**, the signal may appear to be back in the center, but an artifact message continues to be displayed until the **0.05 to 100 Hz** signal actually returns to the center for longer than 2 seconds.

If the saturation of the signal causes the waveform to move between the top and bottom of the display and the waveform does not stay in the middle of the display long enough, then the clinician should change the primary lead or decrease ECG waveform size. If saturation of the signal is continuously at the top or continuously at the bottom for extended periods of time, electrode contact should be checked or replaced.

Poor Electrode Connections

Poor electrode connection can be the cause for any form of ECG interference. The clinician should check and replace lead wires or electrodes as necessary. When applying electrodes, prep the area as recommended under subhead **Procedures** earlier in this section.

Most clinical applications use the default of **0.5 to 40 Hz** for the **Display filter** setting. The diagnostic mode (**0.05 to 100 Hz**) is mainly used to troubleshoot the cause of artifact, especially the presence of line interference. If a user is getting an artifact message and the display looks clean with the **Display filter** set at **0.5 to 40 Hz**, turning on the diagnostic mode bandwidth can make visible the artifact present in the waveform.

While attempting to troubleshoot the electrode connections, see subhead **Silencing the ARTIFACT alarm**.

Silencing the ARTIFACT alarm

While attempting to determine the source of the interference or if the interference cannot be removed, the ARTIFACT alarm may be silenced using one of two approaches. The approach taken depends on what parameters are being monitored on your patient.

If you are monitoring multiple parameters (i.e., ECG and SpO_2), you may choose to set **Artifact detection** to **low** and disable the ARTIFACT alarm. To disable the ARTIFACT alarm, choose **OFF** for **Artifact** in the **other alarm priorities** extended menu. Be aware that if detection of artifact continues, the ECG parameter becomes unable to calculate a heart rate. When this occurs, the HR/Pulse will automatically be derived from another source (i.e., SpO_2).

If ECG is the only available source for HR/Pulse, you may choose to set **Artifact detection** to **low**. If, however, the ARTIFACT alarm continues, you may choose to set **Artifact detection** to **OFF.** Even in periods of artifact, setting **Artifact detection** to **OFF** will allow the determination of a heart rate value from the ECG signal. If the source of interference cannot be found, then you may choose to leave **Artifact detection** set to **OFF**. Bench testing has demonstrated that in a 60 Hz environment (very high), an accurate heart rate can be determined. At high heart rates, however, accuracy may be affected. Heart rates above 200 bpm may not be as accurate as specified (± 3 bpm or 3% of reading, whichever is greater).

The user should return the **Artifact detection** to the **standard** setting as soon as possible once the interference is removed. The user should note that, when **Artifact detection** is set to **OFF,** periods of artifact might interfere with the heart rate value due to the counting of interference as heartbeats. If the accuracy of any determination reading is questionable, you should check the patient's vital signs by alternate means.

ECG Alarms		
Name of Alarm	**Probable Cause**	**Response**
Asystole	no QRS detected for 3 to 6 seconds (user selectable)	message appears in waveform area and alarm message field; alarm forces HR/Pulse value to zero
Primary Lead Fault	no lead is available from which to derive HR	message appears in waveform and alarm message field; HR/Pulse value is forced to dashes if it's the only source
ECG Artifact	• muscle (motion) artifact • 60 Hz, high frequency noise • baseline wander	when first detected, message appears in waveform area; if condition continues, HR/Pulse value is forced to dashes if it's the only source, and alarm is issued based on its priority
Amplitude Low	low voltage QRS occurs when primary lead amplitude is below 0.25 mV (adult and neonate)	message appears in waveform area and alarm message field - with priority set to **OFF**, no audible alarm sounds and message only appears in waveform area; will not appear red
Replace Electrodes	• ECG lead polarization (saturation) from electrodes being left on patient over recommended 48 hours • defibrillation (monitor will recover after defibrillation)	message appears in waveform area and alarm message field; HR/Pulse value is forced to dashes if it's the only source

Heart Rate/Pulse

Procedure Checklist

- Prepare patient
- Connect monitoring lines
- Select **Pulse** from **Setup parameters** option in **Main** menu
- Set up monitoring parameters

Description

Heart rate/pulse (HR/Pulse) in DINAMAP® PRO 1000 Monitors can be derived from one of several sources. In descending order of priority, they are ECG, pulse oximetry (SpO_2), and noninvasive blood pressure (NIBP). Instead of choosing a single source of HR/Pulse, you can activate the auto feature to choose the best available source.

A label designating the source of the HR/Pulse data appears in the HR/Pulse field of the screen. The color of this value changes based on the current source (optional). Beats are indicated in the HR/Pulse field by a blinking heart symbol that is synchronized with an optional audible QRS (pulse) tone.

When ECG is the source, HR/Pulse values are calculated as straight or weighted averages over the previous 5 or 10 seconds. Weighted average formulas compensate for artifact. The default is a weighted average over 10 seconds and is adjustable in **Advanced settings**. The HR/Pulse field is labeled with ECG.

When SpO_2 is the source, HR/Pulse values are derived from the pulse oximetry signal, and the HR/Pulse field is labeled SpO_2. When SpO_2 is the source for HR/Pulse, pulse rate (derived from SpO_2) appears only in the HR/Pulse field (dashes appear for PR in the SpO_2 field when **View SpO2 PR?** option is set to **yes**). In addition, if the QRS volume is on, the pitch of the pulse tone is proportional to the oxygen saturation value. If SpO_2 is the source and the Monitor is unable to detect a pulse for 10 seconds during normal SpO_2 monitoring, the values flash, alternating between patient values and dashes. The Monitor returns to normal SpO_2 reporting of values when several consecutive, good pulse determinations are made. If this condition is active, dashes will be used in the areas where SpO_2 is being displayed or recorded (e.g., freeze, trends, history, and printouts).

The HR/Pulse parameter has audible and visible alarms to let you know when the HR/Pulse is outside the high or low limit. When the source of HR/Pulse indicates a zero rate (e.g., detection of ECG ASYSTOLE, SpO2 LOST PULSE), the HR/Pulse value is forced to zero, resulting in a low limit alarm.

Indications and Contraindications

DINAMAP® PRO 1000 Monitors are indicated for monitoring heart rate/pulse. This device is not designed, sold, or intended for use except as indicated.

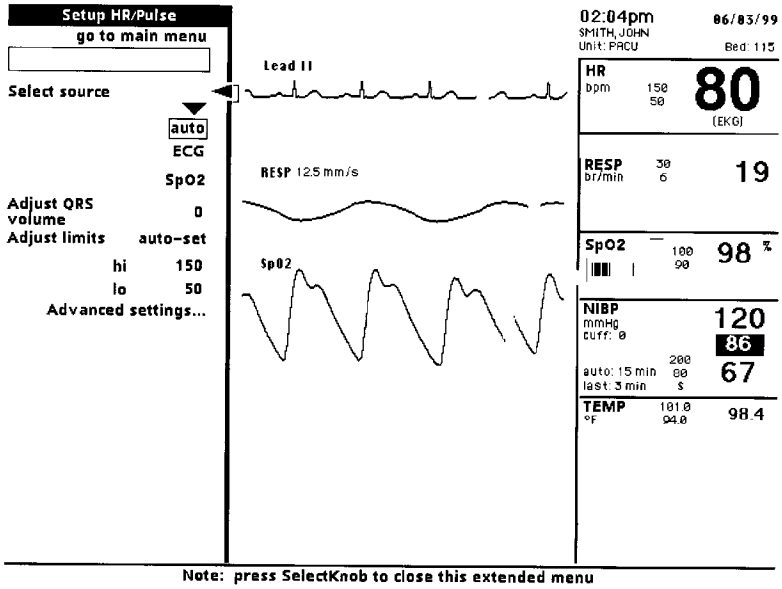
General Notes

- Because the various sources measure or derive HR/Pulse differently from each other, changing from one source to another may change the value in the HR/Pulse field.
- Because it is not a continuously monitored parameter, NIBP cannot be chosen as a source for HR/Pulse. NIBP will become the source only if no other source is available.
- A patient's vital signs may vary dramatically during the use of cardiovascular agents such as those that raise or lower blood pressure or those that increase or decrease heart rate.
- T waves that are greater than 100% of the amplitude of the QRS may be counted as pulses.
- Turning off ECG artifact detection when ECG is the source for HR/Pulse may affect the accuracy of the HR value, since artifact spikes may be detected as QRS.
- If an SpO_2-derived pulse rate is erratic, the pulse oximeter parameter may be unable to measure the pulse and may cause an alarm.

Procedures

1. Prepare the patient according to the instructions for the parameter you are using.
2. Connect the monitoring lines.
3. Choose **HR/Pulse** from the **Setup parameters** option in the **Main** menu, and set up the desired monitoring parameters.

HR/Pulse Menu



Select source

This option lets you choose the source of the HR/Pulse data to be displayed on the screen. The current source is shown in this field, and the other options are in an extended menu. The options are **auto** and the sources that are available from the active parameters. If you choose **auto,** the HR/Pulse parameter will choose the best available source.

Adjust QRS volume

This option lets you adjust the volume of the tone that sounds each time a QRS complex is detected and should be adjusted "on" for SpO_2 desaturation tones. If you set the volume to zero, no tone will sound.

Adjust limits

The adjustable and auto-set alarm limits are shown in the table. Choose **hi** to change the high alarm limit and **lo** to change the low alarm limit. The system maintains appropriate separation between the high and low limits. Choose **auto-set** to use the patient's current readings in setting the high and low limits.

HR/Pulse Alarm Limits				
Heart Rate/ Pulse	**Adjustable**		**Auto-set choice: 20%, 30%, 40%**	
	Low	**High**	**Low**	**High**
adult/ped/neonate	10-245 (bpm)	15-250 (bpm)	current reading minus chosen percentage	current reading plus chosen percentage

Advanced settings

Limit alarms priority

This option lets you choose the priority of the limit alarms.

Specifications

ECG

Heart rate accuracy	10 to 300 (adult/ped) / 10 to 350 (neonate) beats/min ± 3 beats/min or 3% of reading, whichever is greater
Time to alarm:	high heart rate < 10 s per AAMI EC13 - 1992 low heart rate < 10 s per AAMI EC13 - 1992 cardiac standstill < 10 s per AAMI EC13 - 1992 tachycardia waveforms < 10 s per AAMI EC13 - 1992

SpO_2

Range	20 - 250 beats/min
Accuracy	± 3 beats/min

Noninvasive Blood Pressure

Range	
Adult/ped	30 - 200 beats/min
Neonate	30 - 220 beats/min
Accuracy	± 3.5%

Alarm Limits

10 - 250 beats/min

HR/Pulse Alarms		
Name of Alarm	**Cause**	**Response**
HR High	value is greater than "hi" alarm limit	message appears in alarm message field; parameter label, violated limit (if limits set to display), and value in violation flash in vital signs field
HR Low	value is less than "lo" alarm limit	message appears in alarm message field; parameter label, violated limit (if limits set to display), and value in violation flash in vital signs field

RESP

Procedure Checklist

- Make sure electrodes are positioned properly
- Select **RESP** from **Setup parameters** option in **Main** menu
- Set up monitoring parameters

Description

Respirations are monitored in the DINAMAP® PRO 1000 Monitor by the ECG parameter.

Respiration rate derived from the ECG signal is designated RESP. As long as patient data are being collected and analyzed by the ECG parameter, a respiration rate value appears in the vital signs area of the screen.

The ECG parameter calculates respiration rate by measuring the thoracic impedance between two electrodes. As the patient breathes, the movement of the chest changes the impedance, and the differences produce the respiration rate in the RESP vital signs area of the screen.

Respiration rate (RESP) derived from ECG automatically appears when the ECG parameter can display waveforms for lead I, II, III, or MCL_1 and the **Turn on RESP with ECG?** option is turned on. If **Turn on RESP with ECG?** is turned off, RESP does not appear until it is selected from **Setup parameters** in the **Main** menu.

Audible and visible alarms warn you when the respiration rate is outside the selected high or low limit.

Indications and Contraindications

DINAMAP® PRO 1000 Monitors, when used with appropriate parameters, are indicated for monitoring respiration rate. This device is not designed, sold, or intended for use as an apnea monitor.

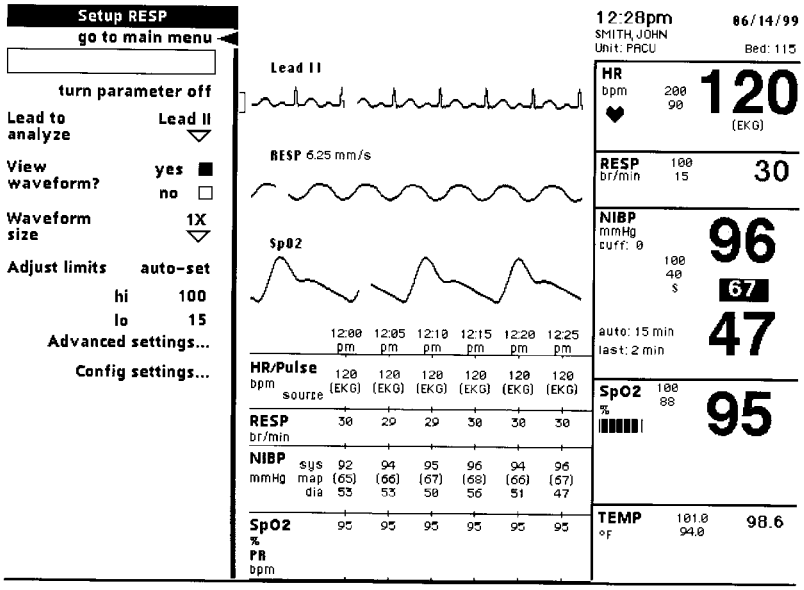
General Warning

Certain artifact conditions and some pacemakers can cause inaccurate detection of impedance respirations. Pacemakers may cause sufficient artifact to trigger false detection of respiration. Always observe pacemaker patients closely.

Procedures

1. If you intend to use the ECG parameter as the source of respiration rate, make sure that the electrodes are positioned properly for measuring impedance respiration. Refer to "Electrode Placement Site" in the ECG section for correct positioning.
2. Choose **RESP** from the **Setup parameters** option in the **Main** menu, and set up the desired monitoring parameters.

RESP Menu



Turn parameter off

This option lets you suspend all monitoring and alarms for RESP. When you choose this option, no vital sign area is allocated to RESP, and the message **Offline-RESP** appears in **Setup parameters**. To resume monitoring, choose **Offline-RESP** from **Setup parameters**.

Lead to analyze

This option lets you choose whether the impedance RESP will be derived from Lead I or Lead II.

View waveform?

You can use this option to choose whether or not the impedance respiration waveform appears on the screen.

Waveform size

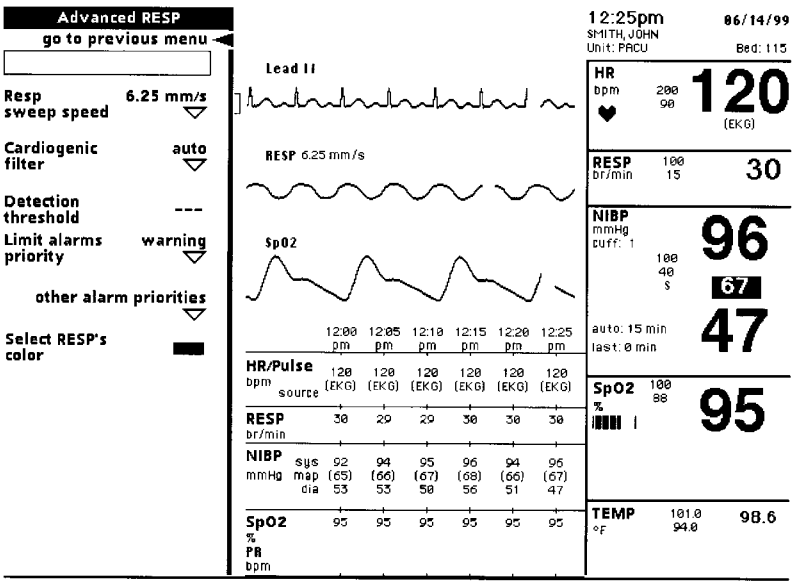
This option lets you change the height of the respiratory waveform to one fourth, one half, one, two, four, or eight times the standard height. The selections are **X/4**, **X/2**, **1X**, **2X**, **4X**, and **8X**. The chosen waveform size appears next to the RESP label in the waveform area when it is a setting other than **1X**.

Adjust limits

The adjustable and auto-set alarm limits are shown in the table. Choose **hi** to change the high alarm limit and **lo** to change the low alarm limit. The system maintains appropriate separation between the high and low limits. Choose **auto-set** to use the patient's current values in setting the high and low limits.

RESP Rate Alarm Limits				
Heart Rate/Pulse	**Adjustable**		**Auto-set choice: 20%, 30%, 40%**	
	Low	**High**	**Low**	**High**
Adult/pediatric	6-115 (bpm)	11-120 (bpm)	current reading minus chosen percentage	current reading plus chosen percentage
Neonate	6-175 (bpm)	11-180 (bpm)	current reading minus chosen percentage	current reading plus chosen percentage

Advanced settings


Advanced RESP
go to previous menu
Resp sweep speed 6.25 mm/s
Cardiogenic filter auto
Detection threshold ---
Limit alarms priority warning
other alarm priorities
Select RESP's color
Lead II
RESP 6.25 mm/s
SpO2
12:25pm
SMITH, JOHN
Unit: PACU
06/14/99
Bed: 115
HR bpm 200 90 120 (EKG)
RESP br/min 100 15 30
NIBP mmHg cuff: 1 100 40 96 67 47
auto: 15 min
last: 0 min
SpO2 % 100 88 95
TEMP °F 101.0 94.0 98.6
12:00 pm 12:05 pm 12:10 pm 12:15 pm 12:20 pm 12:25 pm
HR/Pulse bpm source 120 (EKG) 120 (EKG) 120 (EKG) 120 (EKG) 120 (EKG) 120 (EKG)
RESP br/min 30 29 29 30 30 30
NIBP mmHg sys 92 94 95 96 94 96
map (65) (66) (67) (68) (66) (67)
dia 53 53 50 56 51 47
SpO2 % 95 95 95 95 95 95
PR bpm

RESP sweep speed

This option, which appears in all menus associated with respiratory waveforms, lets you change the speed of all respiratory waveforms to **6.25 mm/s**, **12.5 mm/s**, or **25.0 mm/s**. The chosen sweep speed appears next to the RESP label in the waveform area.

Cardiogenic filter

This option activates and deactivates the cardiogenic filter and lets you decide how the breath detection threshold is determined. When you choose **auto**, the PRO 1000 Monitor uses information about the amount of cardiac artifact to automatically set the breath detection threshold. When you choose **manual**, the cardiogenic filter is deactivated and you can manually set the breath detection threshold using the **Detection threshold** option.

Detection threshold

This option is accessible only when the cardiogenic filter is set to **manual**. When you choose this option, a horizontal line appears on the impedance waveform and a number representing the current detection threshold appears next to the menu option. The number is the position of the line as a percentage of the displayed waveform. Turning the *Select*Knob moves the line up and down and changes the number in the box. You must press the *Select*Knob to set the detection threshold. The horizontal line then disappears from the waveform. A new breath is counted each time the measured impedance goes above and then below the detection threshold.

Limit alarms priority

This option lets you choose the priority of the limit alarms.

Other alarm priorities

This option lets you choose priorities for **resp approaching, lead fail, saturation,** and **artifact** alarms.
Note: When in manual mode, **resp approaching** compares the most recent heart rate interval to the most recent breath interval. The alarm is activated if the breath interval is within (approximately) ±10% of the heart rate interval.

Specifications

ECG-Derived Respiration Rate

Leads available	I or II
Range	6 to 120 breaths/min (adult/pediatric) 6 to 180 breaths/min (neonate)
Accuracy	± 2 breaths/min or ± 3% of reading; whichever is greater
Resolution	1 breath/min
Base Impedance	100 to 2000 Ω
Detection Sensitivity	0.2 Ω @ 30 breath/min with 500 W baseline impedance
Bandwidth	0.1 to 5.0 Hz
Excitation Frequency:	61.5 kHz
Amplitude:	< 300 µA rms

Respiration Alarms		
Name of Alarm	**Cause**	**Message**
Resp High **Resp Low**	value is greater than "hi" alarm limit value is less than "lo" alarm limit	message appears in alarm message field; parameter label, violated limit (if limits set to display), and value in violation flash in vital signs field
Resp Lead Fail	electrode unattached or improperly attached	message appears in waveform and alarm message field; parameter label flashes in vital signs field; alarm forces value to dashes
Resp Baseline Saturation	signal is not valid due to excessive noise or an electrode problem	message appears in waveform and alarm message field; parameter label flashes in vital signs field; alarm forces value to dashes
Resp Rate Approaching HR	patient's RESP rate approaches heart rate	message appears in waveform and alarm message field; parameter label flashes in vital signs field
Resp Artifact	invalid signal due to excessive noise (patient movement or loose electrode)	message appears in waveform and alarm message field; parameter label flashes in vital signs field; alarm forces value to dashes

NIBP

Procedure Checklist

- Connect hose to NIBP parameter
- Measure patient's limb and select properly sized cuff
- Connect cuff to hose
- Squeeze air from cuff
- Place cuff on patient
- Manual mode: press **GO/STOP** hardkey once to obtain immediate determination
- Select **NIBP** from **Setup parameters** option in **Main** menu to set or change limits or to set up auto mode
- Auto mode: quick-press **AUTO-BP/STAT** hardkey to begin auto BP determinations
- Stat mode: press-and-hold **AUTO-BP/STAT** hardkey to obtain continuous determinations for 5 minutes

Description

Blood pressure is monitored noninvasively in the DINAMAP® PRO 1000 Monitor by a noninvasive blood pressure (NIBP) parameter that uses the oscillometric method of measurement. The oscillometric method measures the amplitude of the pressure oscillations within the blood pressure cuff. Further information about the oscillometric method is in the appendix, Principles of Noninvasive Blood Pressure Determination, at the end of this section.

Systolic pressure, diastolic pressure, mean arterial pressure, and cuff pressure are displayed in the NIBP field. The time elapsed since the last determination appears in the NIBP field for a period of 120 minutes. After 120 minutes, the NIBP display area is blanked. Pulse rate derived from NIBP may be displayed in the HR/PULSE field. Directions for obtaining the pulse rate from NIBP are in the HR/Pulse section of this manual.

The NIBP parameter has three operating modes: manual, auto, and stat. The selected mode is shown on the screen. In manual mode, which you access by pressing the **GO/STOP** hardkey, the NIBP parameter determines the blood pressure one time. In auto mode, which you access from the **Setup NIBP** menu or by quick-pressing the **AUTO-BP/STAT** hardkey, the NIBP parameter determines the blood pressure at specified time intervals from 1 to 120 minutes. In stat mode, which you access by press-and-holding the **AUTO-BP/STAT** hardkey until a confirmation tone sounds, the NIBP parameter determines the blood pressure as many times as possible in 5 minutes.

The NIBP parameter senses the type of hose being used and automatically uses adult/pediatric monitoring parameters or neonatal monitoring parameters, as appropriate.

Audible and visible alarms warn you when a value for systolic pressure, diastolic pressure, mean arterial pressure, or pulse rate (when NIBP is the source) is outside the selected high or low limit.

Indications and Contraindications

The NIBP parameter is indicated for use in noninvasive monitoring of blood pressure and pulse rate as a component of the DINAMAP® PRO 1000 Monitors. This device is not designed, sold, or intended for use except as indicated.

General Warnings

• The NIBP parameter will not measure blood pressure effectively on patients who are experiencing seizures or tremors.

• Arrhythmias will increase the time required by the NIBP parameter to determine a blood pressure and may extend the time beyond the capabilities of the parameter (120 seconds - adults only).

• PRO 1000 Monitors display the results of the last blood pressure determination for 120 minutes or until another determination is completed. If a patient's condition changes between one determination and the next, the NIBP parameter will not detect the change or indicate an alarm condition.

• Devices that exert pressure on tissue have been associated with purpura, skin avulsion, compartmental syndrome, ischemia, and/or neuropathy. To minimize these potential problems, especially when monitoring at frequent intervals or over extended periods of time, make sure the cuff is applied appropriately and examine the cuff site and the limb distal to the cuff regularly for signs of impeded blood flow.

• Do not apply external pressure against cuff while monitoring. Doing so may cause inaccurate blood pressure values.

• Use care when placing cuff on extremity used to monitor other patient parameters.

• DINAMAP® PRO 1000 Monitors are designed for use only with dual-tube cuffs.

• Use only accessories recommended by Critikon. Failure to use recommended accessories may result in inaccurate readings.

• Blood pressure cuffs should be removed from the patient when the monitor is powered off. If the extremity remains cuffed under these conditions or if the interval between blood pressure determinations is prolonged, the patient's limb should be observed frequently and the cuff placement site should be rotated as needed.

General Cautions

• Accuracy of NIBP measurement depends on using a cuff of the proper size. It is essential to measure the circumference of the limb and to choose the proper size cuff. The air hoses are color-coded according to size of the patient. The gray hose, 12- or 24-foot (3.66 m or 7.3 m), should be used on patients who require cuff sizes from infant through thigh cuffs. The teal (blue-green) hose, 12-foot (3.66 m), is required for the neonatal cuff sizes #1 through #5.

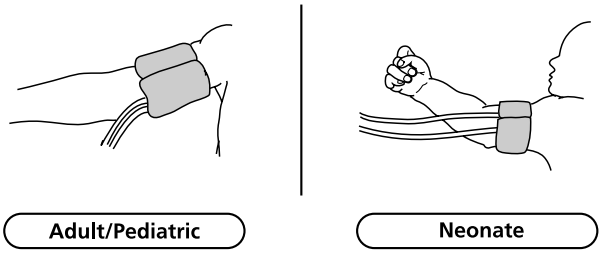
• The pulse rate derived from an NIBP determination may differ from the heart rate derived from an EKG waveform because the NIBP parameter measures actual peripheral pulses, not electrical signals or contractions from the heart. Differences may occur because electrical signals at the heart occasionally fail to produce a peripheral pulse or the patient may have poor peripheral perfusion. Also, if a patient's beat-to-beat pulse amplitude varies significantly (e.g., because of pulsus alternans, atrial fibrillation, or the use of a rapid-cycling artificial ventilator), blood pressure and pulse rate readings can be erratic, and an alternate measuring method should be used for confirmation.

General Notes

- A patient's vital signs may vary dramatically during the use of cardiovascular agents such as those that raise or lower blood pressure or those that increase or decrease heart rate.
- Because treatment protocols based on the patient's blood pressure may rely on specific values and differing measurement methods, such as auscultatory, clinicians should note a possible variance from values obtained with PRO 1000 Monitors in planning patient care management.
- PRO 1000 Monitor values are based on the oscillometric method of noninvasive blood pressure measurement and correspond to comparisons with intra-aortic values within ANSI/AAMI SP10 Standards for accuracy (a mean difference of ± 5 mmHg, and a standard deviation of ± 8 mmHg.)
- This equipment is suitable for use in the presence of electrosurgery.

Procedures

1. Connect the air hose to the NIBP port on the side of the Monitor. Make sure that the hose is not kinked or compressed.
2. Choose the appropriate blood pressure measurement site. Because normative values are generally based on this site and as a matter of convenience, the upper arm is preferred. When upper arm size or shape or the patient's clinical condition or other factors prohibit use of the upper arm, the clinician must plan patient care accordingly, taking into account the patient's cardiovascular status and the effect of an alternative site on blood pressure values, proper cuff size and comfort. The figure shows the recommended sites for placing cuffs.

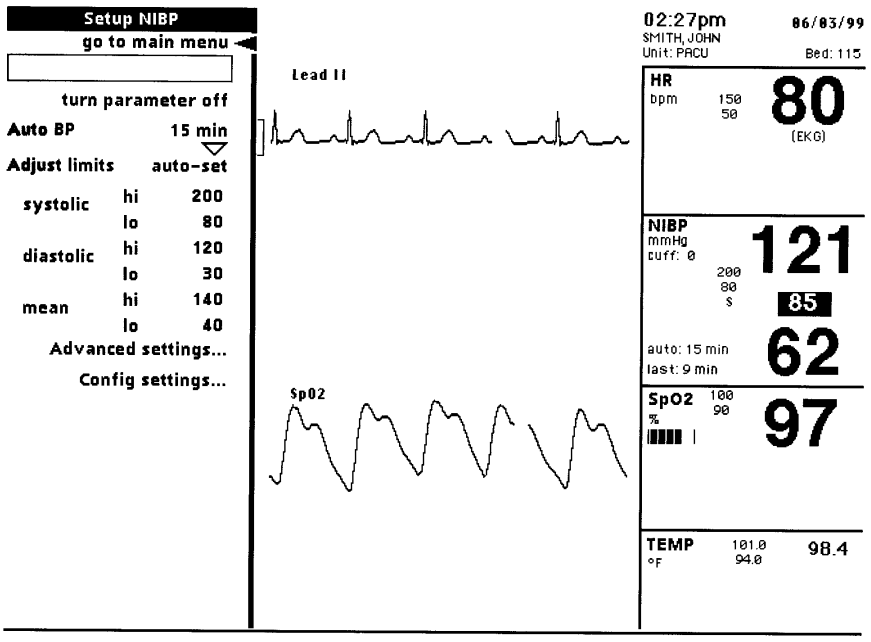


Recommended Cuff Placement

Warning: Do not place the cuff on a limb being used for intravenous infusion or any area where circulation is compromised or has the potential to be compromised.

3. If patient is standing, sitting, or inclined ensure that cuffed limb is supported to maintain cuff at level of patient's heart. If cuff is not at heart level, the difference in systolic and diastolic values due to hydrostatic effect must be considered. Add 1.80 mmHg to values for every inch (2.54 cm) above heart level. Subtract 1.80 mmHg from values for every inch (2.54 cm) below heart level.
4. Choose appropriate cuff size. Measure patient's limb and choose appropriately sized cuff according to size marked on cuff or cuff packaging. When cuff sizes overlap for a specified circumference, choose the larger size cuff.
   Precaution: Accuracy depends on use of proper size cuff.
5. Inspect cuff for damage. Replace cuff when aging, tearing or weak closure is apparent. Do not inflate cuff when unwrapped.
   Precaution: Do not use cuff if structural integrity is suspect.
6. Connect the cuff to the air hose.
   Warning: It is mandatory that the appropriate hose and cuff combination be used. Any attempt to modify the hose will inhibit the NIBP parameter from switching between the neonatal and adult measurement modes.
7. Inspect patient's limb prior to application.
   Precaution: Do not apply cuff to areas where skin is not intact or tissue is injured.
8. Palpate artery and place cuff so that patient's artery is aligned with cuff arrow marked "artery."
9. Squeeze all air from cuff and confirm that connection is secure and unoccluded and that tubing is not kinked.
10. Wrap cuff snugly around the patient's limb. Cuff index line must fall within range markings. Ensure that hook and loop closures are properly engaged so that pressure is evenly distributed throughout cuff. If upper arm is used, place cuff as far proximally as possible.
11. Proper cuff wrapping should be snug, but should still allow space for a finger between patient and cuff. Cuff should not be so tight as to prevent venous return between determinations.
    Warning: Using a cuff that is too tight will cause venous congestion and discoloration of the limb, but using a cuff that is too loose may result in no readings and/or inaccurate readings.
12. Choose **NIBP** from the **Setup parameters** option in the **Main** menu, and set up the desired monitoring parameters.
13. The Monitor beeps once to signal the completion of the determination and values are posted in the vital signs area.

NIBP Menu



Turn parameter off

This menu option enables you to suspend all monitoring and alarms for NIBP. When you choose this option, no vital sign area is allocated to NIBP and the message **Offline-NIBP** appears in **Setup parameters**. To resume monitoring, choose **Offline-NIBP** from **Setup parameters** or press the **GO/STOP** or **AUTO-BP/STAT** hardkey.

Auto BP

This option lets you set time-cycled (auto mode) NIBP determinations. Measurements will occur at intervals of **1-, 2-, 3-, 4-, 5-, 10-, 15-, 30-, 60-, 90-,** or **120**-minutes. In auto mode, determinations are synchronized with the system clock giving the user the convenience of having the readings fall on every quarter-hour, half-hour, and hour, etc., depending upon the time interval setting. For example, if the current time was 8:07 and **15 min** is chosen for **Auto BP,** after the first auto determination, other auto determinations would be started at 8:15, 8:30, 8:45, 9:00. The only time interval not synched to the clock is **1** minute. If you choose **120** minutes, the auto determinations fall every two even-numbered hours: 12:00, 2:00, 4:00, etc.
Note: To cancel the determination in progress, press the **GO/STOP** hardkey. To cancel auto mode, choose **manual**.

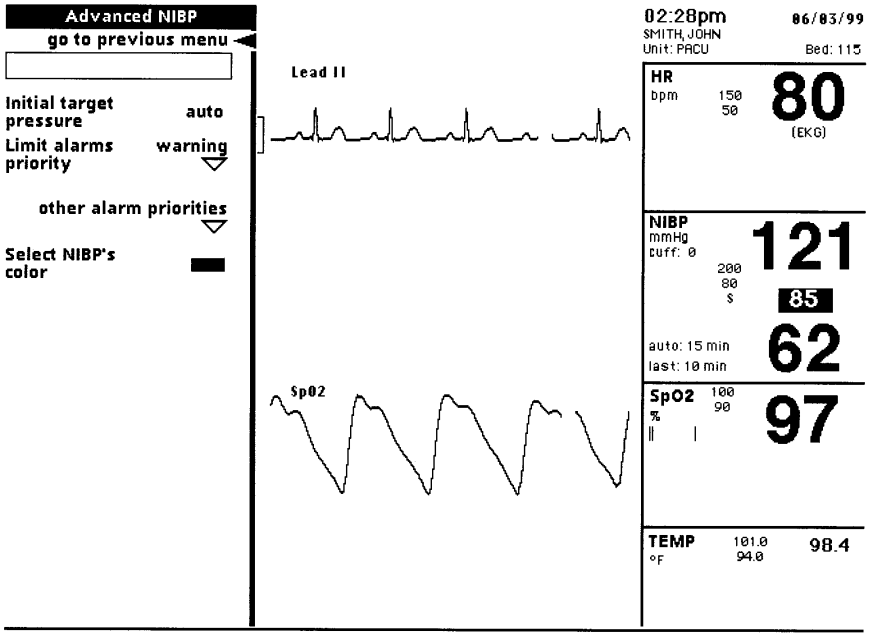
Adjust limits

The adjustable and auto-set alarm limits are shown in the table. Choose **hi** to change the high alarm limit and **lo** to change the low alarm limit. You can set high and low limits individually for systolic, diastolic, and mean values. The system maintains appropriate separation between the high and low limits. Choose **auto-set** to use the patient's current readings in setting the high and low limits.

NIBP Alarm Limits (mmHg)

	Patient	Adjustable		Auto-set choices: 20%, 30%, or 40%		
		Low	High	mmHg	Low	High
Systolic	adult/ped	30 - 285	35 - 290	> 25	current reading minus chosen percentage	current reading plus chosen percentage
				≤ 25	current reading minus 5	current reading plus 5
	neonatal	30 - 135	35 - 140	> 25	current reading minus chosen percentage	current reading plus chosen percentage
				≤ 25	current reading minus 5	current reading plus 5
Mean	adult/ped	20 - 255	25 - 260	> 25	current reading minus chosen percentage	current reading plus chosen percentage
				≤ 25	current reading minus 5	current reading plus 5
	neonatal	20 - 120	25 - 125	> 25	current reading minus chosen percentage	current reading plus chosen percentage
				≤ 25	current reading minus 5	current reading plus 5
Diastolic	adult/ped	10 - 215	15 - 220	> 25	current reading minus chosen percentage	current reading plus chosen percentage
				≤ 25	current reading minus 5	current reading plus 5
	neonatal	10 - 105	15 - 110	> 25	current reading minus chosen percentage	current reading plus chosen percentage
				≤ 25	current reading minus 5	current reading plus 5

Advanced settings



Initial target pressure

This option lets you choose the initial pressure for the next cuff inflation. Initial target pressures for subsequent determinations are based upon the systolic values of previous determinations for the same patient. For adult/pediatric patients, adjust the pressure between 100 to 250 mmHg (in increments of 5). For neonate patients, adjust between 100 to 140 mmHg (in increments of 5). An "auto" selection is also available which uses the target pressure defaults of the NIBP parameter. These defaults are based on patient type and the parameter's algorithm for determining blood pressure.

Note: Selecting a target pressure will clear old NIBP values in the vital signs area.

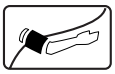
Limit alarms priority

This option lets you choose the priority of the limit alarms.

Other alarm priorities

This option lets you choose priorities for **no determination, overpressure, pump timeout, total timeout,** and **level timeout.**

NIBP Hardkeys

GO/STOP Hardkey 

The **GO/STOP** hardkey, which turns green when activated, initiates a noninvasive blood pressure determination. If the **GO/STOP** hardkey is active, pressing the hardkey again cancels the determination. If the **GO/STOP** hardkey is pressed while in an auto mode determination, only the determination in progress is canceled; NIBP remains in auto mode. If the **GO/STOP** hardkey is pressed while in stat mode, any determination in progress as well as stat mode is canceled.

Note: The **GO/STOP** hardkey is unavailable if an **OVERPRESSURE ALARM** is active.

AUTO-BP/STAT Hardkey

The **AUTO-BP/STAT** hardkey initiates auto and stat determinations and opens the Auto BP menu for quick access to set the auto cycle time. The **AUTO-BP/STAT** hardkey remains amber, except in stat mode it blinks.

The time between auto-BP determinations is user-selected (1-, 2-, 3-, 4-, 5-, 10-, 15-, 20-, 30-, 60-, 90-, and 120-minute intervals). The time between stat determinations will be at least 4 seconds (8 seconds for neonates) once the pressure has reached at least 15 mmHg (5 mmHg for neonates).

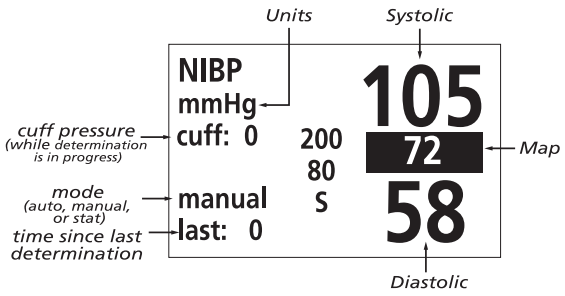
Notes

- The **AUTO-BP/STAT** hardkey is unavailable if an **OVERPRESSURE** alarm is active. The single-press function of this hardkey is unavailable if: 1) the **freeze** hardkey is active or 2) an adjuster menu is open.
- During a **stat** determination, the Monitor will sound a tone and display the early systolic pressure. The early systolic value will disappear once the blood pressure determination is complete. Early systolic is not shown for the first STAT determination.
- If the unit is on battery operation and battery life is at or below 10%, **stat** determinations will not be enabled. However, current **stat** determinations will be completed if underway at the time of the **battery low** alarm.

Auto Mode

Auto mode determinations are started automatically when a time interval is selected in the **Auto BP** menu or when the **AUTO-BP/STAT** hardkey is quick-pressed. If a manual determination is in progress, it is considered to be the first of the auto mode determinations. If stat mode is active, auto mode starts when the stat determinations are complete. In auto mode, determinations are synchronized with the system clock giving the user the convenience of having the readings fall on every quarter-hour, half-hour, and hour, etc., depending upon the time interval setting. For example, if the current time was 8:07 and **15 min** is chosen for **Auto BP,** after the first auto determination, other auto determinations would be started at 8:15, 8:30, 8:45, 9:00, etc. **Warning: The NIBP parameter should be set to determine blood pressures only as frequently as is clinically indicated to ensure adequate patient monitoring.**

- To start the series of auto NIBP determinations, choose a time interval. The first determination starts, and **auto:XX min** (the time you have selected) appears in the vital signs field. Subsequent determinations will start automatically at the specified time interval.
- To cancel the auto mode, choose **manual**; determinations are no longer automatically started. Any determination in progress is completed.
- To start an NIBP determination between scheduled auto determination times, press the **GO/STOP** hardkey.
- To stop an auto determination that is in progress, press the **GO/STOP** hardkey. The cuff will deflate, and the cycle time will start again from zero.
- When NIBP auto BP is on, the cycle time counter is not reset due to the completion of a manual determination.
- If a patient alarm occurs during the first auto determination, another auto determination will start in order to verify the alarm.
- If an NIBP NO DETERMINATION alarm occurs, the Monitor repeats up to nine more auto determinations attempting to achieve valid values. If the cycle completes and no valid values are obtained, the Monitor returns to normal operation with no further repeat determinations. If at any time during this repeat cycle the NIBP NO DETERMINATION alarm is acknowledged by choosing the SelectBox or the **GO/STOP** hardkey is pressed, the repeat cycle is stopped and no repeat determinations are started again until a determination results in valid values.



Manual Mode

You can start a single NIBP determination at any time by pressing the **GO/STOP** hardkey.
Note: Because the **GO/STOP** hardkey is an on-off switch, you can cancel a manual, auto, or stat (time-cycled) NIBP determination in progress at any time by pressing this key.

Stat Mode

Stat mode starts 5 minutes of continuous NIBP determinations. Upon initiation of stat mode, the NIBP and stat labels in the vital signs area blinks yellow. Once either the systolic or MAP derived vital sign is updated with a new value (including early systolic), all three vital signs turn yellow and blink. These vital signs remain yellow and blinking until stat mode is terminated.

You can take multiple NIBP readings at any time by press-and-holding the **AUTO-BP/STAT** hardkey until you hear a confirmation tone. Stat mode takes precedence over all other NIBP modes. If you press-and-hold **AUTO-BP/STAT** when a manual determination is not in progress, a 5-minute series of determinations starts. If you press-and-hold **AUTO-BP/STAT** when a manual determination is in progress, that determination becomes the first in the series. If you press **GO/STOP** during a series of stat determinations, you will cancel the determination in progress and the rest of the series. During stat mode, all NIBP limit alarms are suppressed both during and at the end of the 5 minutes of determinations. At the end of stat mode, the Monitor returns to either manual mode or auto mode (if a time interval is selected in the **Auto BP** menu).

The series begins with cuff inflation to a pressure above previous systolic value or, if no previous systolic is stored, to the configured initial target inflation pressure. The initial target pressure selection for neonates has a maximum pressure of 140 mmHg. Artifact rejection is relaxed in stat mode for adult/pediatric patients to allow for accelerated determinations. During stat determinations, systolic, diastolic, mean, and pulse rate values will not be checked against their limits. An "early" systolic appears in the NIBP field when possible. When mean or MAP, pulse, and diastolic pressure values are determined, the PRO 1000 Monitor sounds a short tone and the updated values appear. Another determination begins once the pressure falls below 5 mmHg for 8 seconds for neonates or below 15 mmHg for 4 seconds for adults, unless the 5-minute period has ended, or you have pressed the **GO/STOP** hardkey.

Mean Arterial Pressure (MAP)

Several conditions may cause the NIBP parameter to calculate and display only the mean arterial pressure (MAP) without a systolic and diastolic reading. These conditions include very low systolic and diastolic amplitude fluctuations, so an accurate calculation for these values can't be made (e.g., patient in shock); too small of a difference between systolic and MAP calculations in relationship to the difference between diastolic and MAP; or a leak has occurred in the Monitor.
1. Check all NIBP connections.
2. Monitor may need calibration and leak testing.

Note: If MAP is the only value displayed, dashes (–) will appear for systolic and diastolic. The alarm message **No Determination** is also displayed.

Cuff Cleaning and Disinfection

Notes
Product must be thoroughly cleaned with the specified detergent before reuse. The additional use of household bleach as described below provides low level disinfection.

- Apply cuff hose caps before cleaning.
- The following cleaning procedure was repeated once on CLASSIC-CUF™ and SOFT-CUF™ cuffs and 20 times on DURA-CUF® cuffs without affecting the performance of cuffs.
- While this procedure is adequate for disinfection, it may not remove all stains on SOFT-CUF™ cuffs.

Definitions

hook	Stiff bristled closure material on the cuff that grabs the loop.
loop	Soft portion of the closure system; attaches to hook.
swatch	Primary cuff fabric.

Materials

- Enzymatic detergent such as ENZOL* enzymatic detergent [US] or CIDEZYME* enzymatic detergent [UK]
- Distilled water
- 10% solution of household bleach (5.25% sodium hypochlorite) in distilled water
- Soft cloths and soft-bristled brushes
- Spray bottles

Procedure

1. Prepare the enzymatic detergent according to the manufacturer's instructions and the 10% bleach solution in separate spray bottles.
2. Spray the detergent liberally on the soiled area of the cuff. If the material is dried on, allow the cuff to sit for 1 minute.
   • For soil on the loop or swatch, wipe the material off with a soft cloth. For persistent contamination in the loop area, use a soft-bristled brush to loosen particles. Rinse with copious amounts of distilled water. Repeat until no visible contamination remains.
   • For soil on the hook part of the closure, use a soft-bristled brush to remove the material, and rinse with copious amounts of distilled water. Repeat until no visible contamination remains.
3. For visible soil on the cuff tubing, use a soft-bristled brush to remove material, as needed, and rinse with copious amounts of distilled water. Repeat until no visible contamination remains.
4. Spray the 10% bleach solution on the affected area until the area is saturated. Allow the cuff to sit for 5 minutes.
5. Wipe away any excess solution and rinse the cuff again with distilled water. Allow 2 hours for drying.

The user has the responsibility to validate any deviations from the recommended method of cleaning and disinfection.

For additional information on infection control procedures, contact Critikon Technical Support via telephone (U.S.A. only), 1 877 274 8456 or telefax 1 813 887 2898.

Service

Calibration of the parameter should be checked every 12 months or when there is doubt about the validity of the noninvasive blood pressure readings. Calibration should be performed by a qualified service person.

A leak test of the parameter should be performed every 12 months or when there is doubt about the validity of the pressure readings.

Caution: Refer calibration and leak testing to qualified service personnel. Full calibration details are available in the service manual, available from Critikon.

Accessories

One of the following accessory kits is packaged with the NIBP parameter:

NIBP parameter Starter Kit, Adult 12 ft (3.66 m) containing Adult DURA-CUF Cuff and 12 ft (3.66 m) Air Hose

NIBP parameter Starter Kit, Neonatal 12 ft (3.66 m) containing Neonatal Cuff Assortment and 12 ft (3.66 m) Air Hose

NIBP parameter Starter Kit, Adult 24 ft (7.3 m) containing Adult DURA-CUF Cuff and 24 ft (7.3 m) Air Hose

*Trademark of Johnson & Johnson

Cuff-to-hose compatibility

ADULT/PEDIATRIC CUFF TYPE	LIMB CIRCUMFERENCE	REFERENCE NUMBER CLASSIC-CUF / SOFT-CUF / DURA-CUF	USE WITH HOSE NO.
Infant		2618 / 2500 / 2783	107365 Gray, Adult/Ped, 12 ft (366 cm), Quick Disconnect or 107366 Gray, Adult/Ped, 24 ft (732cm), Quick Disconnect
Child	12 cm - 19 cm	2613 / 2501 / 2781	
Child Long	12 cm - 19 cm	- / 2506 / -	
Small Adult	17 cm - 25 cm	2608 / 2502 / 2779	
Small Adult Long	17 cm - 25 cm	- / 2507 / -	
Adult	23 cm - 33 cm	2603 / 2503 / 2774	
Adult Long	23 cm - 33 cm	2647 / 2604 / 2772	
Large Adult	31 cm - 40 cm	2643 / 2504 / 2791	
Large Adult Long	31 cm - 40 cm	2649 / 2644 / 2784	
Thigh	38 cm - 50 cm	2648 / 2505 / 2796	

NEONATAL CUFF TYPE	LIMB CIRCUMFERENCE	REFERENCE NUMBER CLASSIC-CUF / SOFT-CUF	USE WITH HOSE NO.
#1	3 cm - 6 cm	2638 / 2521	107368 Blue Green, Neonatal, 12 ft (366 cm)
#2	4 cm - 8 cm	2633 / 2422	
#3	6 cm - 11 cm	2628 / 2523	
#4	7 cm - 13 cm	2623 / 2524	
#5	8 cm - 15 cm	2619 / 2525	

CUFF ASSORTMENT PACKS	REFERENCE NUMBER
SOFT-CUF Assortment Packs: 1 Infant, 1 Child, 2 Sm. Adult, 2 Adult, 1 Adult Long, 2 Lg. Adult, 1 Thigh	2695
DURA-CUF Assortment Packs: 1 Infant, 1 Child, 1 Small Adult, 1 Adult, 1 Large Adult, 1 Thigh	2699
DURA-CUF Adult Packs: 1 Small Adult, 2 Adult, 1 Adult Long, 1 Large Adult, 1 Large Adult Long	2698
DURA-CUF Child Packs: 2 Infant, 3 Child, 1 Small Adult	2697
CLASSIC-CUF Assortment Packs: 1 Infant, 1 Child, 2 Small Adult, 2 Adult, 1 Adult Long, 2 Large Adult, 1 Thigh	2692
CLASSIC-CUF Cuff Assortment Packs: 2 Neo #1, 3 Neo #2, 5 Neo #3, 5 Neo #4, 5 Neo #5	2693
SOFT-CUF Cuff Assortment Packs: 2 Neo #1, 3 Neo #2, 5 Neo #3, 5 Neo #4, 5 Neo #5	2694

Specifications

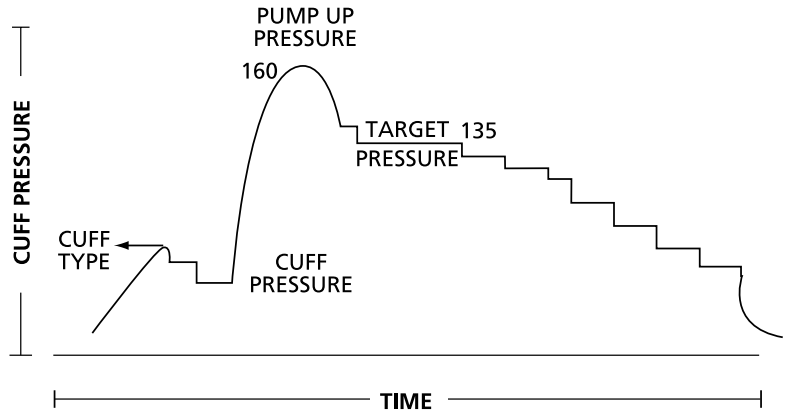
Method	Oscillometric with step deflation
Modes	Manual, automatic, stat
BP Measurement Ranges	
Systolic	30 to 290 mmHg (adult/ped) 30 to 140 mmHg (neonate)
MAP	20 to 260 mmHg (adult/ped) 20 to 125 mmHg (neonate)
Diastolic	10 to 220 mmHg (adult/ped) 10 to 110 mmHg (neonate)
Resolution	1 mmHg
Accuracy	Meets or exceeds AAMI/ANSI standard SP10
Initial Cuff Inflation Pressure	140 mmHg default; user selectable (adult/ped) 110 mmHg default; user selectable (neonate)
Maximum Determination Time	120 s (adult/ped) 85 s (neonate)
Over Pressure Monitor	300 to 330 mmHg (adult/ped) 150 to 165 mmHg (neonate)
Hose/Cuff Interface	Clippard screw connectors at cuff end
Pulse Rate	When NIBP is the source, HR values are derived from the pulse rate that is determined by the oscillometric technique of measuring blood pressure. The rate source field is labeled NIBP. Adult/ped Range: 30 to 200 bpm (± 3.5%) Neonate Range: 30 to 220 bpm (± 3.5%)

Appendix
Principles of Noninvasive Blood Pressure Determination

The oscillometric method of determining NIBP is accomplished by a sensitive transducer which measures cuff pressure and minute pressure oscillations within the cuff. A single determination (in normal mode) is initiated before taking repeated determinations in auto or stat mode. As a determination is taken, the algorithm stores the pattern of the patient's oscillation size as a function of the pressure steps. In auto and stat mode, as few as six pressure steps may be necessary to complete the determination process. When employing fewer pressure steps, the system uses the stored information from the previous blood pressure determination to decide the best pressure steps to take. The algorithm measures the consistency of pulse size to tell if the oscillations taken at a step are good and if more steps are needed.

The first determination initially pumps up to a target pressure of about 160 mmHg for adult patients depending on initial target pressure preset. After inflating the cuff, the NIBP parameter begins to deflate, the oscillations versus cuff pressure is measured, and, finally, systolic pressure, mean pressure, and diastolic pressure are calculated and the screen is updated.

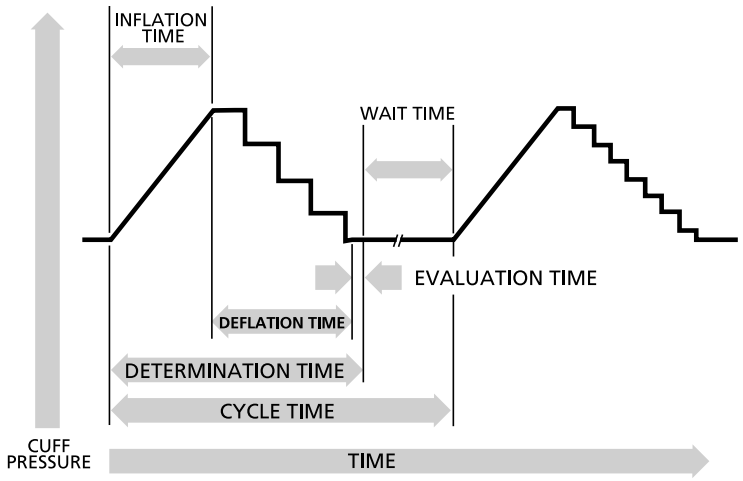
During an NIBP determination, the parameter deflates the cuff one step each time it detects two pulsations of relatively equal amplitude. The time between deflation steps depends on the frequency of these matched pulses (pulse rate of the patient). However, if the monitor is unable to find any pulse within several seconds, it will deflate to the next step. The process of finding two matched pulses at each step provides artifact rejection due to patient movement and greatly enhances the accuracy of the monitor. The figure shows a full determination sequence for an adult patient. In stat mode, the artifact rejection technique of two matching pulses at each step is disabled and some steps may have only one pulse.



Full NIBP Determination Sequence for Adult

At each step the microprocessor stores cuff pressure, the matched pulse amplitude, and the time between successive pulses. The stepped deflation and matched pulse detection continues until diastolic pressure is determined or total cuff pressure falls below 8 mmHg. The parameter then deflates the cuff (to zero detected pressure), analyzes the stored data, and updates the screen.

The operating cycle is composed of four parts: inflation time, deflation time, evaluation time, and wait time. Wait time, which varies from mode to mode, is affected by the cycle time (auto mode) or operator intervention (manual mode). The figure shows the basic operating cycle for an NIBP determination.



NIBP - Auto Mode

Systolic Search

If systolic pressure is not found, the NIBP parameter can search at cuff pressures higher than the initial target pressure. The parameter will inflate the cuff above the initial target pressure to get better data in the systolic region. The maximum pressure allowed in systolic search is limited by the normal range for cuff pressures. In any operating mode, if a patient's systolic pressure exceeds the inflation pressure, the parameter will begin normal deflation sequence, detect the absence of a systolic value, stop deflation, reinflate to a higher (than initial) inflation pressure (290 mmHg maximum), and resume the normal deflation sequence.

Do not use the auscultatory method to verify the accuracy of the NIBP parameter. Auscultatory method (using cuff and stethoscope) calculates the mean pressure value from audible sounds at systolic and diastolic, but the NIBP parameter method detects all three values.

Reverting and Accelerated Determination

When the determination data does not agree with the previous determination, there may be a reversion to a determination with more steps. The algorithm will try to make an accelerated determination of blood pressure if it has been 16 minutes or less since the last determination.

NIBP Alarms		
Name of Alarms	**Probable Cause**	**Response**
Systolic High **Systolic Low**	value is greater than "hi" alarm limit value is greater than "lo" alarm limit	message appears in alarm message field; parameter label, violated limit (if limits set to display), and value in violation flash in vital signs field; **NIBP OUT of LIMITS** appears in *SelectBox*
Mean High **Mean Low**	value is greater than "hi" alarm limit value is greater than "lo" alarm limit	message appears in alarm message field; parameter label, violated limit (if limits set to display), and value in violation flash in vital signs field; **NIBP OUT of LIMITS** appears in *SelectBox*
Diastolic High **Diastolic Low**	value is greater than "hi" alarm limit value is greater than "lo" alarm limit	message appears in alarm message field; parameter label, violated limit (if limits set to display), and value in violation flash in vital signs field; **NIBP OUT of LIMITS** appears in *SelectBox*
NIBP No Determination*	insufficient signal	message appears in alarm message field; parameter label flashes in vital signs field; alarm forces values to dashes
NIBP Level Timeout*	remained at one cuff pressure level for more than 1 minute due to motion	message appears in alarm message field; parameter label flashes in vital signs field; alarm forces values to dashes
NIBP Total Timeout*	determination time exceeded 2 minutes due to motion artifact	message appears in alarm message field; parameter label flashes in vital signs field; alarm forces values to dashes
NIBP Pump Timeout*	time for inflation was exceeded or air leak detected	message appears in alarm message field; parameter label flashes in vital signs field; alarm forces values to dashes
NIBP Overpressure*	appropriate level or pressure in the cuff has been exceeded	message appears in alarm message field; parameter label flashes in vital signs field; alarm forces values to dashes

* Alarm message appears in SelectBox.

SpO_2

Procedure Checklist

- Select sensor
- Plug sensor connector into SpO_2 port
- Apply sensor
- Select **SpO_2** from **Setup parameters** option in **Main** menu
- Set up monitoring parameters

Description

Functional oxygen saturation (SpO_2) of arterial blood is monitored in DINAMAP® PRO 1000 Monitors by a pulse oximetry parameter that provides continuous, noninvasive measurements of SpO_2 and can provide displays of pulse rate, a plethysmographic waveform, and a pulse amplitude bar. The pulse amplitude bar graph is proportional to the arterial blood flow. PRO 1000 Monitors utilize pulse oximetry technology from NELLCOR*. To begin SpO_2 monitoring, plug the sensor into the SpO_2 port, place the SpO_2 sensor on the patient's finger, and monitoring begins automatically.

Functional SpO_2 is the ratio of oxygenated hemoglobin to hemoglobin that is capable of transporting oxygen. This ratio, expressed as a percentage, is shown in the SpO_2 field of the screen and is updated with each heart beat. The percentage of SpO_2 is also indicated by a pulse tone that is activated by the **Adjust QRS volume** option in the HR/Pulse menu. The pitch frequency of the tone is proportional to the oxygen saturation value: highest at 100% saturation and lower as the level of saturation falls.

If the Monitor is unable to detect a pulse for 10 seconds during normal SpO_2 monitoring, the values flash, alternating patient values with dashes; and **SEARCH** appears in place of the pulse amplitude bar. The Monitor returns to normal SpO_2 reporting of values when several consecutive, good pulse determinations are made. If this condition is active, dashes will be used in the areas where SpO_2 is being displayed or recorded (e.g., freeze, trends, history, and printouts).

Pulse Rate derived from SpO_2 appears under the following conditions:

- ***View SpO2 PR?*** *is set to* ***yes (option in Config Settings)***:
  When pulse rate (PR) is derived from SpO_2, the value appears in the SpO_2 vital signs field.
  Note: Unless PR is the source for the HR/Pulse, it is only trended when **View SpO2 PR?** is set to **yes**.
- ***View SpO2 PR?*** *is set to* ***no:***
  PR will not appear in the SpO_2 vital signs field, but SpO_2 is still a valid source for the HR/Pulse.
- ***SpO_2 used as the source for the HR/Pulse:***
  Pulse rate derived from SpO_2 appears only in the HR/Pulse vital signs field (dashes appear for PR in the SpO_2 vital signs field).

The SpO_2 parameter has audible and visible alarms to let you know when the SpO_2 levels are outside the alarm limits, as well as artifact detection. If artifact is detected, **ARTIFACT** appears under the pulse amplitude bar in the vital signs area. If **View SpO2 PR?** is set to **yes,** audible and visible alarms for the pulse rate (derived from SpO_2) are activated. The alarm limits for PR are the same as those for HR/Pulse.

Indications and Contraindications

The SpO_2 parameter is indicated for use in continuous, noninvasive monitoring of functional oxygen saturation and in providing pulse rate data as a component of the PRO 1000 Monitors. This device is not designed, sold, or intended for use except as indicated.

General Warnings

• Do not use the SpO_2 parameter during magnetic resonance imaging (MRI). Adverse reactions include potential burns to patients as a result of contact with attachments heated by the MRI radio frequency pulse, potential degradation of the magnetic resonance image, and potential reduced accuracy of SpO_2 measurements. Always remove oximetry devices and attachments from the MRI environment before scanning a patient.

* NELLCOR is a trademark of Mallinckrodt, Inc.

• The use of cardio-green and other intravascular dyes at certain concentrations may affect the accuracy of the SpO_2 measurement.

• The SpO_2 parameter is calibrated to read functional arterial oxygen saturation. Significant levels of dysfunctional hemoglobins such as carboxyhemoglobin or methemoglobin may affect the accuracy of the SpO_2 measurement.

General Cautions

• As with any clip-on sensor, pressure is exerted. The clinician should be cautious in using a clip-on sensor on patients with compromised circulation (e.g., because of peripheral vascular disease or vasoconstricting medications).

• Do not perform any testing or maintenance on a sensor while it is being used to monitor a patient.

• Bright light sources (e.g., infrared heat lamps, bilirubin lights, direct sunlight, operating room lights) may interfere with the performance of the SpO_2 parameter. To prevent such interference, cover the sensor with opaque material.

General Notes

- A patient's vital signs may vary dramatically during the use of cardiovascular agents such as those that raise or lower blood pressure or those that increase or decrease heart rate.
- The SpO_2 parameter is compatible only with NELLCOR™ probes and sensors.
- User or patient-applied parts are latex-free.

Procedures

1. Select a sensor that is appropriate for the patient and the clinical situation.
   Warning: Do not use a damaged sensor or one with exposed electrical contacts.
   Note: To assure optimal performance, use only NELLCOR sensors, which are available from:
   Mallinckrodt, Inc.
   675 MacDonnell Blvd.
   PO Box 5840
   St. Louis, MO 63134
   Phone: 1-800-NELLCOR (USA) Fax: 1-888-222-9799
2. Connect the SpO_2 sensor to the SpO_2 extender cable. Then, connect the SpO_2 cable to the SpO_2 port on the Monitor. (The SpO_2 cable is designed to fit only the SpO_2 port.)
3. Following the directions for use supplied with the sensor, apply the sensor to the patient.

   Warnings

   Patient safety:

   • If you fail to apply the sensor properly, the patient's skin could be injured or the ability of the SpO_2 parameter to measure oxygen saturation could be compromised. For example, a clip-on sensor should never be taped shut. Taping the sensor could damage the patient's skin or impair the venous return, thus causing venous pulsation and inaccurate measurement of oxygen saturation.

   • Excessive pressure from the sensor may cause necrosis of the skin.

   Parameter performance:

   • When an SpO_2 sensor is on a limb that has a blood pressure cuff, the SpO_2 data will not be valid when the cuff is inflated. If SpO_2 readings are required during the entire blood pressure determination, attach the SpO_2 sensor to the limb opposite the one with the blood pressure cuff.

   • Remove nail polish and artificial nails. Placing a sensor on a polished or an artificial nail may affect accuracy.

   Cautions

   Patient safety:

   • Do not place any clip-on sensor in a patient's mouth or on a patient's nose or toe.

   • Do not place a clip-on finger sensor on a patient's thumb or across a child's foot or hand.

• Observe the sensor site to assure adequate distal circulation. Sensor sites should be checked at least every 2 hours and rotated at least every 4 hours.

Parameter performance:

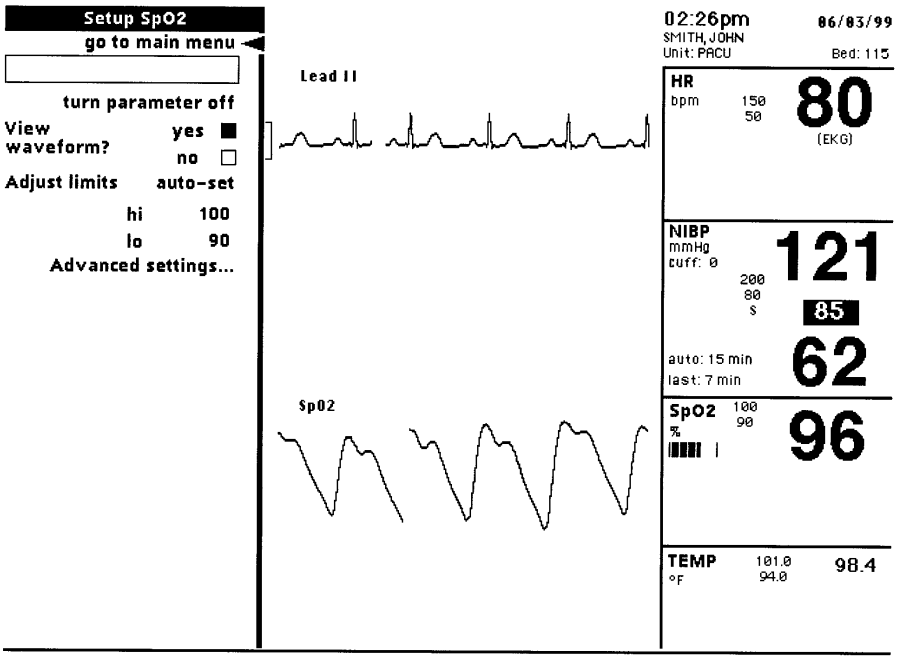
• For best performance, place the sensor at heart level.

• Placing a sensor distal to an arterial line may interfere with adequate arterial pulsation and compromise the measurement of SpO_2.

• Place the sensor so that the LEDs (light emitting diode) and the photodiode are opposite each other.

4. Select **SpO_2** from **Setup parameters** in the **Main** menu and set up the desired monitoring parameters.

SpO_2 Menu



Turn parameter off

This option lets you suspend all monitoring and alarms for SpO_2. When you select this option, no vital sign area is allocated to SpO_2, and the message **Offline-SpO_2** appears in **Setup parameters**. To resume monitoring, select **Offline-SpO_2** from **Setup parameters**.

Note: SpO_2 alarms can only be terminated by either 1) correcting the cause of the alarm or 2) turning the parameter off.

View waveform?

You can choose this option to have the plethysmographic waveform appear on the screen. Select **yes** or **no**.

Adjust limits

The alarm limits for SpO_2 oxygen saturation and SpO_2 PR are shown in the following tables. Select **hi** to change the high alarm limit and **lo** to change the low alarm limit. The system maintains appropriate separation between the high and low limits.

Note: The **auto-set** option is not available for SpO_2. You cannot choose **auto-set** to set the alarm limits for oxygen saturation. However, when SpO_2 is the source for HR/Pulse, using **auto-set** in the **Setup HR/Pulse** menu will set the alarm limits around the SpO_2 PR value.

SpO2 Alarm Limits saturation: %		
	Low	**High**
Adult, pediatric and neonatal	20% - 95%	25% - 100%

SpO2 Alarm Limits: PR*				
Heart Rate/Pulse	**Adjustable**		**Auto-set choice: 20%, 30%, 40%**	
	Low	**High**	**Low**	**High**
adult, pediatric, neonatal	10 - 245 (bpm)	15 - 250 (bpm)	current reading minus chosen percentage	current reading plus chosen percentage

* Only when SpO_2 is the source for HR/Pulse or **View SpO2 PR?** is set to **Yes**.

Advanced settings

View signal strength bar?

This option lets you view the signal strength bar, which is an indication of the strength of the electronic signal produced by the photodiode. A stronger signal makes more bars visible, and a weaker signal makes fewer bars visible. The size of the signal strength bar is proportional to strength of the peripheral pulsations. It is not related to the percentage of oxygen saturation.

View SpO2 PR?

This option lets you view and trend the pulse rate currently being measured by the SpO_2 parameter. This rate may be different from the value displayed for HR/Pulse, because it is calculated from a different source (i.e., ECG). When viewable, the SpO_2 PR value is also checked against the same limits set for HR/Pulse. If this option is set to **no**, the SpO_2 PR value will only be displayed, trended, and checked against limits when it is the source for HR/Pulse.

Cardiac sweep speed

This option lets you set the display sweep speed to **12.5 mm/s**, **25.0 mm/s**, or **50.0 mm/s**. Changes you make to the sweep speed in this menu will affect the sweep speed of all cardiopulmonary waveforms with the possible exception of the primary ECG waveform. The chosen sweep speed appears next to the SpO_2 label in the waveform area when it is a setting other than **25.0 mm/s**.

Limit alarms priority

This option lets you choose the priority of the limit alarms.

Other alarm priorities

This option lets you choose priorities for **lost pulse, sensor disconnected,** and **replace cable** alarms.

Calibration

The SpO_2 parameter does not require calibration.

Accessories

The SpO_2 parameter is supplied with a NELLCOR Starter Kit containing an Interface Cable and a Sensor Assortment Pack. Other sensors and accessories are available from NELLCOR.

Cleaning

Adhesive sensors are sterile and for single use only. Reusable sensors can be cleaned with a 70% alcohol solution. Do not immerse the sensor completely in water, solvents, or cleaning solutions (because the connector is not waterproof). Do not sterilize the sensor by irradiation, steam, or ethylene oxide.

Specifications

Functional Oxygen Saturation:

Range	0% - 100%
Accuracy (± one standard deviation)	0% - 69% - unspecified

Adult Accuracy (70 - 100%)

NELLCOR Sensor	*Accuracy*
OXICLIQ-P pediatric sensor	2.5 digits
OXICLIQ-I infant sensor	2.5 digits
OXICLIQ-A adult sensor	2.5 digits
OXICLIQ-N neonatal/adult sensor	2.5 digits
OXIBAND pediatric/infant sensor	3.0 digits
OXIBAND adult/neonatal sensor	3.0 digits
DURA-Y ear clip	3.5 digits
REFLECTANCE sensor	3.5 digits
DURASENSOR adult	3.5 digits
PEDI-CHECK pediatric spot-check clip	3.5 digits
OXISENSOR II D-20 pediatric sensor	2.0 digits
OXISENSOR II D-25 adult sensor	2.0 digits
OXISENSOR II N-25 neonatal/adult sensor	2.0 digits
OXISENSOR II I-20 infant sensor	2.0 digits
OXISENSOR II D-25L adult sensor, long cable	2.0 digits
OXISENSOR R-15 adult nasal sensor*	3.5 digits

*Accuracy: 80% to 100%; 0 to 79%: unspecified.

Neonatal Accuracy (70% - 100%)

When sensors are used on neonatal subjects as recommended, the specified accuracy range is increased by ±1 digit to account for the theoretical effect on oximeter measurements of fetal hemoglobin in neonatal blood (e.g., N-25 accuracy on neonates is ±3, rather than ±2).

Note: Refer to NELLCOR's sensor specifications.

Pulse Rate Range	20 to 250 beats/min
Accuracy	±3 beats/min
Audible Indicator	Pitch changes with saturation; volume selectable from 0 (off) to 9
Waveforms	Pulse plethysmograph waveform on LCD gain compensated
Sensor Connect/ Disconnect From Patient	Monitor will detect attachment or disconnection of sensor from patient within 15 s
Pulse Detection	Monitor will detect pulse or enter no signal state within 15 s of being attached to patient
Loss of Pulse	If the Monitor is unable to detect a pulse for 10 sec during normal SpO_2 monitoring, the values flash, alternating patient values with dashes; and **SEARCH** appears in place of the pulse amplitude bar.
Sensor Light Source	
Wavelength	Infrared: 920 nm (nominal) Red: 660 nm (nominal)
Power Dissipation	Infrared: 22.5 mW (max) Red: 30 mW (max)

Troubleshooting

This section discusses potential difficulties and suggestions for resolving them. If the difficulty persists, contact a qualified service person or your local representative.

The service manual, which is for use by qualified service personnel, provides additional troubleshooting information.

PROBLEM: The signal strength symbol tracks a pulse, but no oxygen saturation or pulse rate values appear on the screen.
CAUSE:

- Excessive patient motion may be making it impossible for the SpO_2 parameter to find a pulse pattern.
- The sensor may be damaged.
- The patient's perfusion may be too low to allow the SpO_2 parameter to measure saturation and pulse rate.

SOLUTION:

- *Check the patient.*
- If possible, keep the patient still; check whether the sensor is applied securely and properly and replace it if necessary; move the sensor to a new site; use a sensor that tolerates more motion.
- Replace the sensor.

PROBLEM: The SpO_2 value or the pulse rate changes rapidly; the signal strength symbol is erratic.
CAUSE:

- Excessive patient motion may be making it impossible for the SpO_2 parameter to find a pulse pattern.
- An electrosurgical unit (ESU) may be interfering with performance.

SOLUTION:

- *Check the patient.*
- If possible, keep the patient still; check whether the sensor is applied securely and properly and replace it if necessary; move the sensor to a new site; use a sensor that tolerates more motion.
- If an ESU is interfering:

  1. Move the SpO_2 cable as far from the ESU as possible.
  2. Plug the Monitor and the ESU into different AC circuits.
  3. Move the ESU ground pad as close to the surgical site as possible.
  4. The sensor may be damp or may need to be replaced with a new sensor.
  5. If using a sensor extension cable, remove it and connect the sensor directly to the SpO_2 parameter.
  6. If the patient weighs less than 3 kg or more than 40 kg, apply an OXISENSOR N-25 oxygen transducer to an appropriate site. This sensor has added protection against electrosurgical interference.

PROBLEM: The oxygen saturation measurement does not correlate with the value calculated from a blood gas determination.
CAUSE:

- The SpO_2 calculation may not have correctly adjusted for the effects of pH, temperature, pCO_2, fetal hemoglobin, or 2, 3-DPG.
- Accuracy can be affected by incorrect sensor application or use, intravascular dyes, bright light, excessive patient movement, venous pulsations, electrosurgical interference, and placement of a sensor on an extremity that has a blood pressure cuff, arterial catheter, or intravascular line.

SOLUTION:

- Check that calculations have been corrected appropriately for the relevant variable. In general, calculated saturation values are not as reliable as direct laboratory hemoximeter measurements.
- If there is excessive light, cover the sensor with opaque material.
- Circulation distal to the sensor site should be checked routinely. The site must be inspected every 2 hours to ensure adhesion, skin integrity, and correct optical alignment. If skin integrity changes, move the sensor to another site.
- Try to keep the patient still, or change the sensor site to one with less motion.
- Observe all instructions, warnings, and cautions in this manual and in the directions for use of the sensor.

PROBLEM: A valid SpO_2 signal was present but has disappeared.
CAUSE:

- An NIBP determination on the same limb is in progress.

SOLUTION:

- An alarm message (**lost pulse**) will appear on the screen, but the audible alarm will not sound. After 15 seconds or when the NIBP determination is completed, if the SpO_2 signal still is not present the audible alarm will sound.

PROBLEM: The SpO_2 signal has disappeared but the value persists, and an alarm does not occur immediately.
CAUSE:

- The algorithm provides for the SpO_2 value to be maintained for 10 seconds after the signal has disappeared before an alarm is generated.
- Probe may have become dislodged.

SOLUTION:

- *Check the patient.*
- If possible, keep the patient still; check whether the sensor is applied securely and properly and replace it if necessary; move the sensor to a new site; use a sensor that tolerates more motion.

SpO_2 Alarms		
Name of Alarm	**Cause**	**Response**
SpO_2 High **SpO_2 Low**	Value is greater than "hi" alarm limit Value is less than "lo" alarm limit	message appears in alarm message field; parameter label, violated limit (if limits set to display), and value in violation flashes in vital signs field
SpO_2 PR High* **SpO_2 PR Low***	Value is greater than "hi" alarm limit as set in HR/Pulse Value is less than "lo" alarm limit as set in HR/Pulse	message appears in alarm message field; parameter label, PR label, violated limit, violated PR limit (if limits set to display), and value in violation flashes in vital signs field
SpO_2 Sensor Disconnected	sensor disconnected from module	message appears in waveform and alarm message field; parameter label flashes in vital signs field
SpO_2 Lost Pulse	no or very low SpO_2 signal, signal was lost	message appears in waveform and alarm message field; parameter label flashes in vital signs field
SpO_2 Replace Cable	SpO_2 sensor or cable possibly defective, cable not connected properly	message appears in waveform and alarm message field; parameter label flashes in vital signs field

* Not active when **View SpO_2 PR** is set to **no**.

Temperature

Procedure Checklist

- Select temperature probe
- Connect probe cable to parameter
- Place temperature probe on or in patient
- Select **TEMP** from **Setup parameters** option in **Main** menu
- Make sure correct determination mode is chosen
- Set up monitoring parameters

Description

The temperature parameter in the DINAMAP® PRO 1000 Monitor uses IVAC* technology and can be used with both oral (blue) and rectal (red) temperature probes. All information in the vital signs area while a determinations in progress appears either red or blue, respective to the type of temperature probes being used. Two modes of operation are available: predictive and monitor. If a determination can be started, it begins when the temperature probe is removed from the probe holster. The Monitor beeps once whenever a temperature probe is removed from and returned to the probe holster.

Notes

- When any temperature alarms are generated, dashes are displayed in the vital signs area and any determination in progress is terminated. To cancel these alarms, return the temperature probe(s) to the probe holster, choose the alarm message in the *Select*Box, or choose the **turn parameter off** option.
- Anytime dashes are displayed for the temperature value, dashes also appear in the time since last determination (**last : --**).
- Once the probe has been removed from the probe holster and anytime the temperature parameter is turned off, all old determination values are cleared.

Temperature is shown on the vital signs area in degrees Celsius or Fahrenheit, and the unit of measure is indicated by the °C °F display.

Indications and Contraindications

DINAMAP PRO 1000 Monitors are indicated for monitoring temperature. This device is not designed, sold, or intended for use except as indicated.

General Warning

• The performance of the Monitor may be degraded if it is operated outside of the environmental conditions specified.

General Cautions

• Be careful not to overextend the coiled cord of the temperature probe. Overextension can damage the probe coil connector interfaces.

• Accurate oral temperatures (blue) can only be obtained by placing the probe under the tongue in the right or left sublingual pocket. Temperatures in other locations in the mouth can vary by more than 2 °F or 1 °C.

• Accurate rectal temperatures can only be obtained by using the red temperature probe. Red and blue temperature probes are *not* interchangeable.

• Ensure temperature probes are returned to and stored in the correct probe holsters. If not, a TEMP CHECK PROBES alarm occurs on the next attempted temperature determination.

• Do not allow the tip of the predictive temperature probe to come into contact with a heat source (e.g., hands or fingers) prior to taking a temperature determination. If this occurs, allow 5 seconds for the probe tip to cool before proceeding.

• Use only IVAC* probes and probe covers. The size, shape, and thermal characteristics of the probe covers can affect the performance of the instrument. Inaccurate readings or retention problems may occur unless IVAC probes and probe covers are used.

* IVAC is a trademark of ALARIS Medical Systems

Predictive Mode

In predictive mode, a final temperature is displayed. The sound of the first beep signals that the temperature determination is complete, and the Monitor continues beeping for up to 12 beeps or stops when the probe is replaced into the probe holster. When a predictive mode determination is in progress, the determination terminates when a final value is achieved, when the probe is inserted back into the probe holster, or when a TEMP status alarm is issued. During a predictive temperature determination, the temperature display provides a progress meter. In the vital signs area, four arrows forming a "chase sequence" indicate a predictive temperature determination is in progress.

When a predictive determination ends in a final value, the time since the determination completed is displayed in the vital signs area in the format of **last : xxx** min where xxx is the number of minutes since the determination completed. The final temperature value remains in the vital signs area until a new determination begins or until 120 minutes have lapsed. After that time, dashes replace the old determination value.

Monitor Mode

Monitor mode is most commonly used for axillary temperature determinations. In monitor mode, the display is updated continually (after an initial warm-up period) as the patient's temperature rises or falls. When a monitor mode determination is in progress, **MONITOR MODE** flashes under the temperature value in the vital signs area, and dashes are displayed until the temperature value is stable. Once stabilized, values appear in the vital sign area and the **MONITOR MODE** label stops flashing. The determination terminates when the probe is inserted back into the probe holster or a TEMP status alarm is issued.

A time indicator in the vital signs area shows the length of time since the probe was last removed from the probe holster. It appears in the format of **YY : XX** where **YY** is the elapsed minutes and **XX** is the elapsed seconds. When the length of determination extends to over 60 minutes, dashes (-- : --) appear, but the temperature value remains. When monitor mode is in progress and a recording is started, the temperature value is printed out as dashes.

Procedures for Oral Predictive Mode Determinations

For oral temperature measurement, use the blue oral probe.

1. Ensure probe is in the correct holster according to color-coding: blue probe in blue holster.
2. Connect the temperature probe cable to either temperature probe connector.
3. Make sure correct determination mode is selected. Predictive mode is the default setting.
4. Remove the appropriate temperature probe from the probe holster (the Monitor beeps once). Place a protective temperature probe cover on the probe.
5. Have the patient open his/her mouth slightly. Holding the probe loosely, insert the probe tip into the sublingual pocket where the richest blood is located.
6. Hold the probe during the entire temperature measurement process, and keep the probe tip in contact with the tissue at all times. Do not allow the patient to reposition the probe.
7. The determination begins automatically. Hold the temperature probe steady until the determination is complete. This takes approximately 60 seconds, during which time a pattern of arrows in the vital signs area appears as a "chase sequence" to indicate progress.
8. When the determination is complete, up to 12 beeps sound and the temperature appears on the display.
9. Remove the probe. Discard the disposable cover by holding the probe as you would a syringe and pressing the button on the probe handle. Place the probe in the appropriately colored probe holster (the Monitor beeps once).

Procedures for Rectal Predictive Mode Determinations

For rectal temperature measurement use the red rectal probe.

1. Ensure probe is in the correct holster according to color-coding: red probe in red holster.
2. Connect the temperature probe cable to either temperature probe connector.
3. Make sure correct determination mode is selected. Predictive mode is the default setting.

4. Remove the appropriate temperature probe from the probe holster (the Monitor beeps once). Place a protective temperature probe cover on the probe. Failure to firmly install the probe cover may result in the probe cover becoming loose or disengaged during use. Be careful not to press the probe ejection button where the cord exits the probe as this might loosen or eject the probe cover.
5. Touch the tissue about a half inch (1.3 cm) above the sphincter muscle and carefully insert the probe, using current hospital technique for penetration. (The use of a lubricant is optional.)
6. The determination begins automatically. To ensure continuous tissue contact and maximize patient comfort, hold the probe in position until the determination is complete. This takes approximately 60 seconds, during which time a pattern of arrows in the vital signs area appears as a "chase sequence" to indicate progress.
7. When the determination is complete, up to 12 beeps sound, and the temperature value and the label "rectal" appears on the display.
8. Remove the probe. Discard the disposable cover by holding the probe as you would a syringe and pressing the button on the probe handle. Place the probe in the appropriately colored probe holster (the Monitor beeps once).

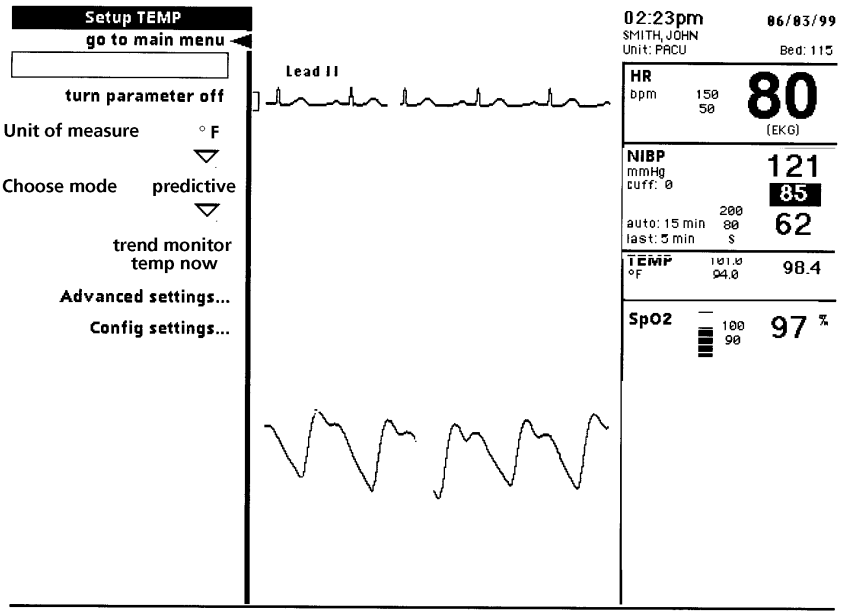
Procedures for Monitor Mode Determinations (Axillary Determinations)

1. Ensure probe is in the correct holster according to color-coding: red probe in red holster; blue probe in blue holster.
2. Connect the temperature probe cable to either temperature probe connector.
3. Make sure correct determination mode is selected. Predictive mode is the default setting.
4. Remove the appropriate temperature probe from the probe holster (the Monitor beeps once). Place a protective temperature probe cover on the probe and insert the probe in the patient's axilla, making sure the tip of the probe is in contact with the skin and positioned as close as possible to the axillary artery with the patient's arm held close to his/her side.
5. The determination begins automatically. The dashes in the vital signs area are replaced with a temperature value as soon as the probe warms up. Leave the probe in place for the same length of time as required by standard hospital procedure for taking an axillary temperature. The Monitor does not beep to indicate a final reading.
6. Choose **trend monitor temp now** (if you want to save the value in trends), and remove the probe. Discard the disposable cover by holding the probe as you would a syringe and pressing the button on the probe handle. Place the probe in the probe holster (the Monitor beeps once). Once you place the probe in the appropriately colored probe holster, the temperature values will be cleared.

Notes

- If there is a long delay from the time the probe is removed from the probe holster until it is inserted into the patient's mouth, it is possible that the instrument will not display a final temperature. If this occurs, insert the probe into the probe holster, remove it again, and start a new measurement.
- If an alarm is actively sounding, an audible tone will not sound.
- If a predictive determination value is not achieved within 70 seconds of probe removal, the Monitor alarms.
- If the probe is not inserted/placed within 30 seconds of probe removal, the Monitor may issue an alarm.

TEMP Menu



Turn parameter off

This option lets you suspend all monitoring and alarms for TEMP. When you select this option, no vital sign area is allocated to TEMP, and the message **OFFLINE-TEMP** appears in **Setup parameters**. To resume monitoring, either connect temperature probe to patient, or select **OFFLINE-TEMP** from **Setup parameters**.

Unit of measure

You can choose to have temperature displayed in degrees Fahrenheit or degrees Celsius.

Choose mode

This option lets you choose either **predictive** or **monitor** mode. If no temperature determination is in progress, this choice specifies the type of determination that will be attempted on the next probe removal. If a **predictive** determination is in progress and you choose **monitor** mode, the mode of determination in progress switches from predictive to monitor. If a monitor mode determination is in progress, this option is not available. When you have changed the mode of determination, after the temperature determination completes, the menu choice returns to the configured default setting.

Trend monitor temp now

Choosing this option causes the currently displayed temperature value to be trended. This option is available only during a monitor mode determination when the parameter indicates that values are available for trending. This option becomes available only after the temperature values are displayed in the vital signs area. A maximum of eight temperature values can be trended per minute.

Advanced Settings

Other alarm priorities

This option lets you choose the priority for temperature alarms.

Calibration

The temperature parameter does not require calibration.

Accessories

Use only IVAC* probes and probe covers. The size, shape, and thermal characteristics of the probe covers can affect the performance of the instrument. Inaccurate readings or retention problems may occur unless IVAC* probes and probe covers are used. Probe covers are single-patient use and should be discarded after every determination.

Specifications

Scale	° Fahrenheit (F) ° Celsius (C)
Predictive Mode	
Range	88.9° F (31.6° C) to 108.0° F (42.3° C)
Accuracy	± 1.0° F (± 0.6° C)
Resolution	0.1° F (0.1° C)
Monitor Mode	
Range	80.0° F (26.7° C) to 108.0° F (42.3° C)
Accuracy	± 0.2° F (± 0.1° C) (when tested in a calibrated liquid bath; meets ASTM E1112, Table 1, in range specified)
Resolution	0.1° F (0.1° C)
Probes	Use only IVAC* probes and probe covers. The size, shape, and thermal characteristics of the probe covers can affect the performance of the instrument. Inaccurate readings or retention problems may occur unless IVAC* probes and probe covers are used.

* IVAC is a trademark of ALARIS Medical Systems

Temperature Alarms		
Name of Alarm	**Cause**	**Message**
TEMP Disconnected	temperature probe becomes disconnected	message appears in alarm message field; parameter label flashes in vital signs field; alarm forces value to dashes
TEMP Timed Out	predictive temp value cannot be determined	message appears in alarm message field; parameter label flashes in vital signs field; alarm forces value to dashes
TEMP Probes Same Type	two probes of the same type (and color) are connected to the monitor at the same time	message appears in alarm message field; parameter label flashes in vital signs field; alarm forces value to dashes
TEMP Check Probes	the measured temp value is determined to be out of limits OR bad probe	message appears in alarm message field; parameter label flashes in vital signs field; alarm forces value to dashes
TEMP Two Probes Out	two probes are both connected to the monitor and removed from their probe holsters at the same time	message appears in alarm message field; parameter label flashes in vital signs field; alarm forces value to dashes

Battery

Procedure Checklist

- Only use batteries recommended by Critikon.
- Make sure the battery has been fully charged before using Monitor. (See instructions for new batteries.)
- Make sure the battery icon appears in lower portion of monitor screen when operating on DC power.
- Check the battery icon for the state of charge indication.

Description

The PRO 1000 Monitor uses an internal battery pack. The battery pack is nickel-metal-hydride (NiMH) that can be charged at any time without fear of reducing its charge capacity. Battery connectors are keyed to prevent incorrect installation. In the event the Monitor loses AC power, the unit automatically switches to battery power.

General Warning

• Do not disassemble, open, or shred the battery under any circumstances.

• The battery pack can explode, leak or catch on fire if heated or exposed to fire or high temperatures.

• Do not short circuit the battery pack by directly connecting the metal terminals. Be certain that no metal objects such as coins, paper clips, etc., touch the terminals.

• Charge the battery pack only with PRO 1000 Monitor's internal charger.

General Cautions

• During normal charging or discharging no gases are produced by the battery. In the event of a malfunction that causes overheating or overcharging, individual cells may vent gases to minimize accumulation.

• Do not drop this battery pack or subject it to mechanical shock.

• Use only batteries recommended by Critikon. Other batteries could result in monitor shut down.

Procedures for First Use

Following these procedures will condition a new NiMH battery and optimize its performance.

1. The internal battery pack automatically charges when you plug in the Monitor.
2. When you are charging the battery for the first time, the charger may indicate prematurely that charging is complete. This is normal and can happen with all rechargeable batteries when first charged.

Battery Charging

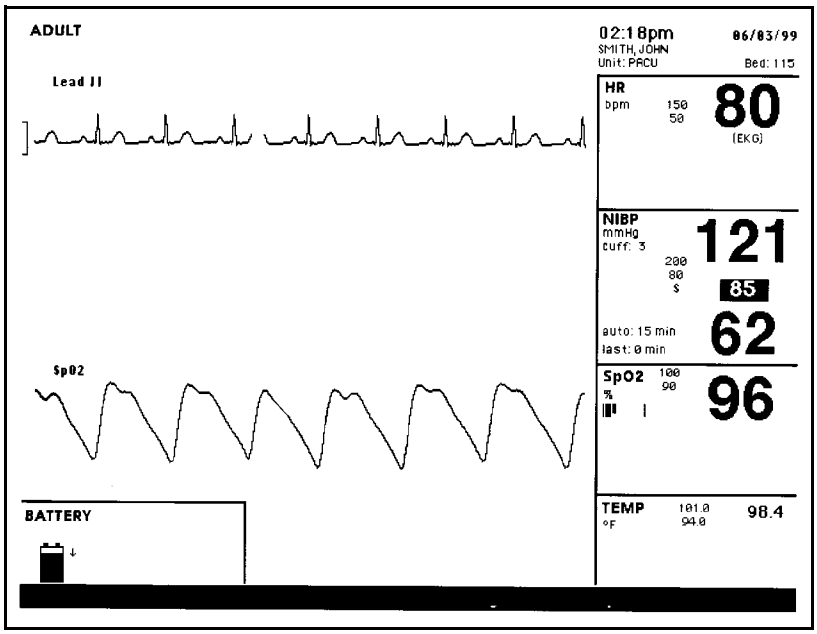
The PRO 1000 Monitor automatically senses if the battery pack needs charging. The battery icon displays the battery condition when the Monitor is operating on battery or if **Always display battery icons?** (in **other system settings**) is set to **yes**. The NiMH battery pack charges when the Monitor is plugged into an AC power outlet or an external DC source greater than 20.5 VDC. You do not need to turn on the Monitor.

- Charge battery pack before first use or after prolonged periods of storage.
- The battery pack should be charged before use, because a charged battery loses charge when left in storage. NiMH batteries discharge to less than 80% of charge within 30 days of storage. Charging is done automatically by the Monitor when it is connected to AC.
- The battery pack should be charged at room temperature (59 °F to 86 °F; 16 °C to 30 °C).
- You can charge or top-off the battery pack at any time. You do not have to wait until battery is fully discharged.
  Note: Before you top-off or charge the battery pack, make sure you have charged and discharged the battery pack three times.

Note: The battery's internal temperature is monitored and will not fast charge if the temperature reaches 57 °F (15 °C) or colder. The battery will charge at a reduced rate until its internal temperature rises above 57 °F (15 °C), after which fast charging will resume. If a battery is 32 °F (0 °C) or colder, it will not charge. If the battery temperature is 118 °F (48 °C) or greater, it will not charge until its internal temperature cools down to 109° F (40 °C).

Battery Icon

The PRO 1000 Monitor displays information concerning the battery (battery presence, battery use, and state of charge,) using an icon in the lower, left portion of the Monitor screen.



The battery icon is always shown when operating from battery power regardless of the **Always display battery icons?** menu setting. You can set the icon to be continuously displayed (even when running on AC power) by choosing **Always display battery icons?** in the **Other system settings** menu. An up arrow (↑) charge indicator appears next to the battery icon if a battery is being charged. If the battery is being discharged to power the Monitor, the battery icon is outlined boldly and a down arrow (↓) charge indicator appears next to it.

If there is a defective battery pack or fuse, or depleted battery and the battery is unable to be recharged, the battery icon appears with the outline of the icon in red, the **BATTERY** label flashes red, and the green LED light flashes. When this occurs, you cannot access battery power until the battery has been recharged or replaced or the fuse has been replaced. No other alarms occur, and this event is not entered into the System Event History.

Battery State of Charge

As the battery pack discharges or charges, increments of the charge level change on the battery icon, showing approximate charge status as a percentage.

% Fill in Battery Icon	Battery Charge Status
> 85% filled	battery completely charged
≥ 50% filled	battery 2/3 full
≥ 15% filled	battery 1/3 full
< 15% filled	**BATTERY LOW** alarm sounds; shutdown imminent

Battery Alarm

The battery alarm appears blinking in the alarm message field. Once the alarm is acknowledged, the Monitor re-arms for the detection of this condition and is automatically reissued every 10 minutes.
Note: A BATTERY LOW alarm will not provide a remote alarm signal.

Loss of Power Shutdown

In the event that the Monitor automatically shuts down due to inadequate AC power and discharged batteries, a loud constant tone sounds to alert you that the unit is no longer operating. The alarm sounds for approximately 5 minutes. The Monitor saves all status and trend information, as well as current configuration data before shutdown.

3.6 V Backup Battery

An internal, 3.6 V, rechargeable nickel-metal-hydride battery helps preserve memory when the Monitor is off. This battery is normally not used and will last for 3 years. It must be changed by a qualified service person.

Specifications

Capacity	7.0 amp-hr (manufacturer's rating)
Battery Life	120 minutes (+/- 10 min) using fully charged internal battery (NIBP: 5-min auto cycle with adult cuff. ECG, RESP, SpO2: Active. TEMP: predictive mode. Printer: printing 2 waveforms for 1 min every 20 min at 25 mm/sec.)
Charge time	3 hours maximum with the Monitor switched off 4 hours maximum with the Monitor switched on

Troubleshooting

This section discusses potential difficulties and suggestions for resolving them. If the difficulty persists, contact a qualified service person or your local Critikon representative.

The service manual, which is for use by qualified service personnel, provides additional troubleshooting information.

PROBLEM: The battery does not work or does not last very long.

CAUSE:

- Has the battery been charged?
- Has the battery been in storage or a nonuse condition for a few months?
- Is the battery installed properly?
- Was the battery over discharged when it was last used?

SOLUTION:

- New batteries must be charged before use. Refer to Battery Charging in this section.
- Upon first use or when battery has been removed from prolonged storage, you need to charge and discharge your battery up to three times before optimum performance.

PROBLEM: The battery only charged for a short period of time before indicating full charge.

CAUSE:

- Are you charging the battery for the first time?
- Did you change the battery fuse while the battery charge level is near full?

SOLUTION:

- When you charge your battery for the first time, your charger may indicate prematurely that charging is completed. This often happens with rechargeable batteries. Discharge the battery and repeat the charging procedure.

PROBLEM: The battery will not charge.

CAUSE:

- Are you trying to charge the battery in unusually cold or hot temperatures?

SOLUTION:

- Charging the battery should be done at a basic room temperature of 59° F (16° C) to 86° F (30° C). Slowly bring the battery to the basic room temperature before charging. Batteries can be fully charged only when their internal temperatures are between 57° F (15° C) and 109° F (40° C).

PROBLEM: The BATTERY LOW alarm appears in the alarm message field, the battery icon turns red, and the green LED light flashes.

CAUSE:

- Did you change or remove the battery fuse while the Monitor was running on battery power?
- The battery is unable to recharge.

SOLUTION:

- The battery needs to be recalibrated or is defective. To recalibrate, simply recharge the battery by plugging the Monitor into AC power. The recharge time may vary depending upon the current battery charge status.

Battery Alarm		
Name of Alarm	**Cause**	**Response**
BATTERY LOW	remaining life in battery has reached 10%	message appears in the alarm message field; once alarm is acknowledged, the Monitor re-arms for the detection of this condition after 10 minutes have elapsed

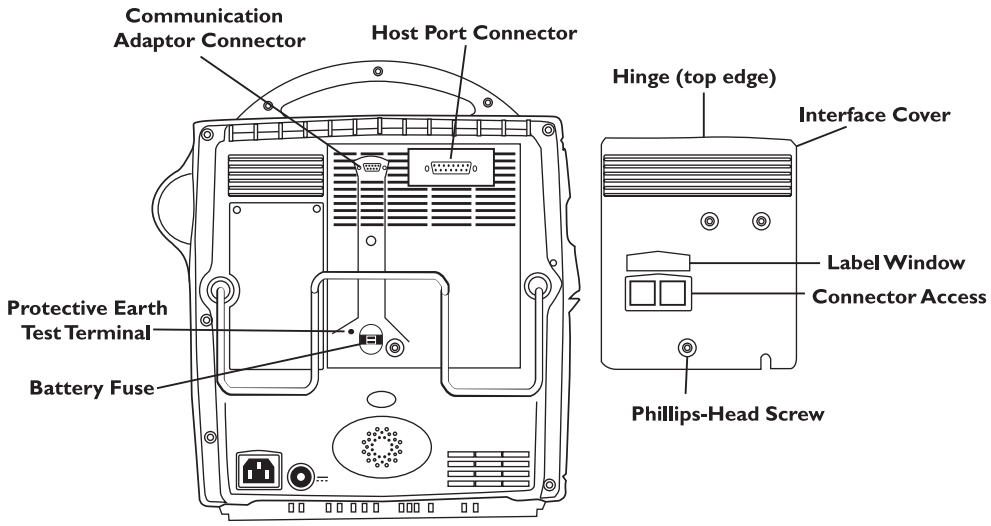
Appendix

2 Appendix

Data Connections

DINAMAP® PRO 1000 Monitors have two communications connectors for remote data access: Communication Adaptor Connector and Host Port Connector.

The data connectors are nonisolated—meaning that electrical connections to this equipment must either have built-in electrical isolation or use a Critikon Communication Adaptor (ILC-1927 or ILC-1928).



Interface Cover

The removable cover is secured to the Monitor through hinge-type latches at the top of the cover and a Phillips-head screw at the bottom center of the cover. Above the screw are three openings intended for connector access and label identification (without removing the cover). A protective earth test terminal and battery fuse are also located behind the Interface Cover.

To remove the Interface Cover:
1. Loosen the captive Phillips-head screw.
2. Lift the cover off the Monitor.

Note: In order to maintain protection from water ingress, the removable protective cover must be replaced before using the Monitor, otherwise, the IPX1 standard cannot be assured or implied.

Communication Adaptor Connector

This connector is reserved for connection to Critikon communication adaptors ONLY.

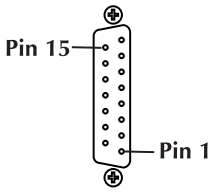
The ILC-1927 connects to the Communication Adaptor Connector and provides two isolated RJ-45 RS-232/422 connections.

The ILC-1928 also connects to the Communication Adaptor Connector. The left RJ-45 connector provides isolated RS-232/422 communication; the right connector provides a 10 Mbps Ethernet connection. A label directly above the RJ-45 connections identifies these functions and is visible through the Interface Cover when it is in place.

Host Port Connector

The Host Port Connector is designed for use with wireless radio devices that do not require isolated output. Electrical levels are 5-volt logic levels or RS-232.The connector also provides a remote alarm signal. When a crisis-priority alarm condition is displayed on the Monitor, a signal appears at the Host Port Connector within 5 seconds. The connector has the capability to supply power for certain Critikon-recommended devices.

WARNING! Auxiliary equipment connected to the DINAMAP® PRO 1000 Monitor will result in the formation of an electromedical system, and thus must comply with the requirements of EN 60601-1-1/ IEC 601-1. All host port signals are NON-ISOLATED and should be connected to equipment conforming to IEC-601-1, configured to comply with IEC 601-1-1 ONLY. If external alarm control is required, a Critikon Isolated Remote Alarm Cable Assembly should ALWAYS be used. Please refer to the Information Sheet included with the isolated remote alarm cable for operational details.
Note: When using remote alarm, the PRO 1000 Monitor should be considered the primary alarm source. The secondary alarm is used for secondary purposes only.



Pin Number	Function
1	Ground
2	Inverted TTL Transmit Data
3	Inverted TTL Receive Data
4	Fused +5 volts
5	Fused +12 volts
6	Serial Level Control
7	Ground
8	Remote Alarm
9	No Connection
10	No Connection
11	RS-232 Transmit Data (TxD)
12	Port Enable Control
13	RS-232 Receive Data (RxD)
14	No Connection
15	No Connection

Electromagnetic Interference (EMI) Considerations

Electromagnetic energy that unintentionally affects the operation of another electrical device is called electromagnetic interference (EMI). One form of electromagnetic energy that can produce EMI is radio waves. Radio waves are emitted from the antennas of cellular phones, citizens band radios, mobile two-way radios (like those used in police, fire, and emergency vehicles), hand-held two-way radios, radio stations, TV stations, amateur radio (ham) transmitters, wireless computer links, microwave sources, and paging transmitters. Because the intensity of electromagnetic energy is greatest near the source (transmitting antenna), EMI from mobile radios is of special concern. The source of EMI caused by radio waves may be difficult to determine since radio waves are invisible and the signals may be intermittent.

DINAMAP® PRO 1000 Monitors have been designed to withstand the effects of EMI and meets IEC 601-1-2 (April 1993), the EMC standard that applies to the monitor. However, extremely high levels of electromagnetic energy (above the levels of IEC 601-1-2) may still produce interference.

To reduce the risk of EMI, follow these recommendations:

- Do not turn on or use hand-held personal communications devices, such as mobile two-way radios and cellular phones, near the monitor.
- In the case of unexplained EMI, consider the locations of nearby transmitters such as radio or TV stations. You may have to move the monitor or place shield material between the transmitter and the monitor.
- Be aware that modifying this monitor or adding accessories or components not specifically authorized by Critikon may make the monitor more susceptible to interference from radio waves.
- When servicing the monitor, use only replacement components authorized by Critikon and be sure to replace all shields, covers, screws, and gaskets, in their exact locations as described in the service manual.
- Do not put paint or labels over any metallic surfaces that have been left bare for continuity of shielding.

Service and Spare Parts

Warning: There are no user-serviceable parts inside the DINAMAP® PRO 1000 Monitor. Refer all servicing to qualified personnel.

Assistance and Parts

If the product malfunctions or if assistance, service, or spare parts are required, contact Critikon Technical Support. Critikon provides an assembly exchange service.

Before contacting Critikon, it is helpful for you to duplicate the problem and check and confirm the operation of all accessories to ensure that they are not the cause of the problem.

When calling, please have the following information at hand:

- product name and model number and complete description of the problem
- the serial number of your Monitor
- your name and address
- a purchase order number if out-of-warranty repairs or spare parts are required
- your Critikon account number, if applicable
- the 6-digit part number for spare or replacement parts

Maintenance, Cleaning, and Calibration

For maintenance and cleaning instructions, please refer to individual parameter sections in this manual. For calibration instructions, refer to the Pre-Service and Calibration Manual.

Repairs

If your product requires warranty, extended warranty, or non-warranty repair service, call Critikon and a representative will assist you.

Estimates for non-warranty repairs are provided at no charge; however, the product must be sent to Critikon for an estimate.

To facilitate prompt service in cases where the product has external chassis or case damage, please advise the representative when you call.

The representative will record all necessary information and will provide a Return Authorization Number. Prior to returning any product for repair, a Return Authorization Number must be obtained.

Packing Instructions

If you have to return goods for service, follow these recommended packing instructions:

- Remove all hoses, cables, sensors, power cords, and ancillary products from the Monitor before packing.
- Wherever possible use the original shipping carton and packing materials.
- Observe the environmental conditions detailed in the Product Overview section of this manual.

It is recommended that all returned goods be insured. Claims for loss or damage to the product must be initiated by the sender.

Auxiliary Output

The auxiliary output is a nonisolated signal input/output meant only for connection to another medical device that is compliant with IEC 601-1.Connection to a noncompliant device could result in a safety risk by exceeding current limits.

The auxiliary output connector provides an analog ECG waveform output. The analog ECG waveform signal is a high level (1 V/mV) representation of the primary lead. The connector is a two-conductor 3.5 mm stereo jack that mates with a 3.5 mm stereo plug (Shogyo SPY 1011, Shogyo SPY 1012, or equivalent). Cable construction should be shielded, three conductor with PVC insulation or equivalent insulating material.

Pin Out:

Tip	No Connection
Ring	ECG Analog Output
Sleeve	Signal Return
Scale Factor*	1 V/mV ± 5%
Output Impedance/ Short Circuit Protection	1k Ω
Bandwidth	0.5 Hz - 100 Hz

* Maximum load of 50 k Ω necessary to maintain scale factor.